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EDITORIAL.

Bark Reserves on Small Rubber Holdings.

Comparisons are frequently made between the consumption of bark on estates and small holdings, which generally result in the conclusion that the system—or lack of system—adopted by the latter leads to the removal of an excessive amount of bark, resulting in insufficient bark renewal and therefore subsequent excessive wounding; in the incidence of brown bast and other diseases and in fact, in a general lowering of the vitality and usefulness of the trees.

If the subject was as simple as this, Malaya would by this time possess a very large area of practically worthless native rubber holdings, whereas, in point of fact, recent statistics prove that the yields of rubber on such holdings continue at a high level. It would therefore appear desirable firstly, to readjust our ideas concerning the potential rubber production from small holdings and secondly, to devise a satisfactory means of arriving at a computation of the amount of bark consumption on such holdings.

Bearing in mind the present low price of rubber, one is apt to adopt the argument that the present high yields from small holdings are entirely the result of necessity—that the small-holder is compelled thereby to press for the production of every possible pound of rubber from his holding. While this is undoubtedly a fact, it is doubtful whether the present practice as indicated above is more harmful than the previous arrangements usual with small-holders, which are at the moment less practised than during periods of high prices, such as the system of leasing the holdings for a period of years, which induces the lessee to press for the production of the highest yields possible; or the very common arrangement whereby the tapper takes half the crop in lieu of wages. Again, while during times of depression the owners of such holdings undoubtedly press for high yields to counterbalance the low prices and thus to obtain sufficient money for the necessities of life, it must not be forgotten that there is a decided inducement for heavy tapping when prices are high. Our view therefore is that the general policy of the small-holder is in the direction of heavy tapping whatever be the condition of the market, and it remains, in view of the desirability of forming a judgment concerning the future of such areas, to estimate the prospects of such holdings by a measurement of the amount of bark consumed.

Whereas the general policy on estates is the maintenance of a limited number of trees per acre in a high state of efficiency, the small-holder has adopted the system of planting a large number of trees per acre and of tapping such of these trees as will yield an appreciable amount of latex. In practice, therefore, the small-holder has a large proportion—variously estimated up to 50 per cent.—of his trees out of tapping. In other words, he is always resting a number of trees and can afford to do so because the system still leaves a number of tappable trees.

Another point of difference between estates and small holdings is that of cultivation. The usual practice on large estates until comparatively recently was clean weeding and even now considerable areas of mature rubber exist in this condition. The system has undoubtedly led to the reduction of fertility by reason of soil erosion and loss of humus. Small-holders, on the other hand, have almost invariably neglected weeding and general cultivation and have therefore retained their soil. Soil retention has been further assisted by the large stand of rubber trees.

Some of the factors which affect bark consumption on rubber owned by small-holders have been indicated above. It will be realised that while good estate practice allows for the removal of about an inch of bark monthly, the small-holder removes about two inches in the same period, but in view of the fact that many of his trees are out of tapping, the average amount of bark removed per month more nearly approximates to the estate results.

The subject of bark reserves on small holdings has been raised by the Rubber Growers' Association and was considered at the Second Inter-departmental Agricultural Conference held at Kuala Lumpur in October last. The problem of evolving a satisfactory system for obtaining, regularly, information on bark reserves was discussed at some length during which the practical difficulties to be overcome were emphasised. This discussion resulted in the appointment of a committee to consider the question further and to decide how far some scheme for obtaining reliable data of the yield, bark consumption and bark reserves on small holdings, was desirable and possible.

If the deliberations of this committee lead to the establishment of suitable means of achieving these objects, a decided step in advance will have been taken to perfect statistical data upon which can be based an appreciation of the future prospects of production.

Spices. Attention is drawn to the spice industry in Penang and Province Wellesley by the publication in this number of two articles bearing on this subject. The spice industry in this country has languished for many years, partly owing to the popularity of rubber planting, and partly no doubt, owing to the damage suffered by the trees in the past on account of pests and diseases against which efficient control measures were not known.

At one time Penang provided the world with nutmegs of the highest quality on the market and although at the present time but a small quantity originates

from this source yet the term " Penang nutmegs " is still used to designate the best quality product. A revival of the industry would be assisted by this commercial asset, and in the light of the greater knowledge which exists on the cultivation of the tree and the control of pests and diseases to which it is prone, we can see no good reason against the re-establishment of the industry.

Stock Feeding. The stock breeder of to-day realises that nutrition is not merely a matter of digestion and assimilation, but that vitamins play an important rôle and minerals exercise a considerable influence on the development, health and vigour of animals.

In the *Malayan Agricultural Journal* published last November will be found an article by Dr. T. B. Orr on " The Role of Vitamins in Stock Feeding." This article should be read with the article included in the present number on "Minerals and Nutrition " by Lt. Colonel H. A. Reid O.B.E. These two articles sum up present day knowledge on these important aspects of stock feeding.

Lt. Colonel Reid for some years held the appointment of bacteriologist and pathologist to the New Zealand Department of Agriculture and has devoted considerable attention to the questions which provide the subject matter of his valuable contribution to this Journal.

Original Articles.

THE CLOVE AND NUTMEG INDUSTRY IN PENANG AND PROVINCE WELLESLEY

BY

F. R. Mason,

Agricultural Field Officer,
Province Wellesley and Penang.

Introductory.

Much has been written concerning the spice industry in the East Indies, particularly by H. N. Ridley, in his book on "Spices" published in 1912. In older publications is found detailed information by the same author, (Agricultural Bulletin of the Malayan Peninsular 1897), and also by Oxley in "The Journal of East Indian Archipelago" and in a paper printed in Logan's Journal in 1848. The object of this article is merely to outline past history, touch briefly upon cultivation, and conclude with a few notes concerning the position of the industry to-day.

History.

Comparatively few people of the present generation in Malaya realise what an important factor the spice industry was to the island of Penang seventy years ago. The nutmeg was known as a spice as early as A.D. 540, and appears to have found its way into Europe through Aden towards the end of the twelfth century. The earliest record of cloves appears to be in Chinese books dating from 260 B.C. to 220 B.C. wherein it is stated that officers of the court were required to hold cloves in their mouths when addressing the Sovereign. From the eighth century cloves were imported into Europe but were very costly, being valued in 1265 at from 10 shillings to 12 shillings a pound.

The Portuguese held the monopoly of both cloves and nutmegs while in possession of the Spice Islands till 1605 when they were expelled by the Dutch. The latter attempted to confine their cultivation to Banda and Amboyna. So much spice did they accumulate in the early years of their occupation that it is on record that a large quantity was burnt in Amsterdam in 1760 to keep the price up.

On the founding of Penang in 1786, by Captain Light, the East India Company took steps to break the Dutch monopoly by sending a botanist named Smith to the Moluccas to obtain plants of cloves and nutmegs. Captain Light

had already obtained clove plants from Mauritius, but all these are said to have died. In 1800 Smith sent some 5,000 nutmeg and 15,000 clove plants to Penang which were planted in a spice garden established by the East India Company. From this garden were established quite a number of European plantations of some size. In 1805 the spice gardens contained 5,100 nutmegs, 1,625 clove trees and 1,050 seedlings, when the gardens were sold for $9,656/-. In about 1850 there were reported to be upwards of 30 spice plantations in Penang and Province Wellesley. The largest of these contained 20,000 trees, the total number of trees in all plantations was stated to be about 80,000 and the gross annual produce was estimated at 130,000 lbs. At this time there were over 24 plantations in Singapore containing 55,925 nutmeg trees of which nearly 15,000 were in full bearing giving a return of over four million nutmegs a year. In 1860 there were 14,500 acres under spices in Penang and Province Wellesley yielding 30—40 pounds per acre. But in that year came the first blow to the industry in the nature of what was termed the "nutmeg disease," which was so destructive as nearly to wipe out the cultivation in Penang and Province Wellesley and in fact did stamp out the plantations in Singapore. Ridley states that there is little doubt that this "disease" was due to attacks by a Scolytid beetle, *Phlocosinus cribratus.* He bases his assumption on a description of the disease by Surgeon Collingwood, but there was no entomologist in the Colony at the time so the position appears doubtful. This beetle has not been observed doing any considerable damage to nutmeg trees during the past five years in which the plantations have been under the observation of the writer, but Gater, in a report dated January, 1924, is of opinion that this insect should be looked upon as a serious pest which, for the time being, is quiescent.

In Penang and Province Wellesley the Chinese, chiefly Khehs, re-started the cultivation of nutmegs and cloves but before it again became well established the introduction of rubber into the country placed the cultivation of spices well in the background, with the result that one now rarely finds a plantation of nothing but spices, they have invariably been inter-planted with or replaced by rubber.

Ridley, writing in 1897 says "Good plantations can also be seen in Malacca (at Pringgit), and in Johore (at Pengerang) and in a few other spots," but as far as is known these plantations have mostly, if not all, disappeared.

Description.

Nutmegs and mace are the products of *Myristica fragrans,* a bushy tree sometimes attaining a height of forty feet. The flowers are yellow in colour, and male and female flowers are, as a rule, on separate trees. Pollination is effected by small insects. The fruit takes nine months to ripen, and is in appearance rather like a peach. It has a thick fleshy pericarp or husk which splits when the fruit is ripe showing the dark brown seed which is covered with a network of bright crimson, known as the mace. Between the nutmeg and the mace is a thin brittle shell; this shell is not usually removed before export

but the seed is dried whole after the removal of the mace, which is dried separately. The Malay name for this spice is "pala," the mace being known as "bunga pala."

The cloves of commerce are the dried unopened flower buds of a tree, *Eugenia Caryophyllata, Thumb.* It is a smaller tree than the nutmeg, only reaching a height of 20—30 feet. It is of a symmetrical conical shape, and very picturesque with its bright green shiny leaves which are very aromatic especially when crushed or bruised. The flowers appear in bunches at the tips of the branches. The fruits have a fleshy pericarp and when ripe are rather like a ripe damson in colour and size but are oblong in shape; they are often referred to as "mother cloves."

The Malay name for this spice is "bungah chengkeh."

Soils and Situation.

Both nutmegs and cloves seem to thrive best in the usual yellow, loamy clay found on the hills of Penang and at Bukit Mertajam in Province Wellesley; the more friable the soil the better the trees seem to thrive. It is stated by Oxley that the deeper the tinge of iron in the soil the better the plants seem to grow. He quotes the hard ferruginous gravel found at Pringgit in Malacca where the two spices once thrived remarkably well. The slopes of Penang hills and Bukit Mertajam are in places exceedingly steep but are broken up by granite rocks which prevent soil wash to a considerable extent; the usual practice is, however, to build up terraces by making small walls of granite boulders, which are readily available, and filling them up with earth, this serves to support the trees and to prevent soil wash.

In Penang and Province Wellesley cloves and nutmegs are generally cultivated on hills from 200 to 2,000 feet above sea level and are rarely seen on the plains, although it is said that cloves will thrive at lower attitudes provided the water table is well below the surface. It is interesting to note that at Bukit Mertajam in Province Wellesley, where every available space was once planted with nutmegs and cloves, the limit of cultivation was reached at under 1,000 feet, above which the trees would not grow. It is often said that nutmegs and cloves must be grown within sight and sound of the sea; this may be an important factor as it is very noticeable that on Bukit Mertajam hill the spices are only planted on the side facing the sea, and also that on Penang hills the best plantations are to be found on the slopes facing the open sea to the West. It is also interesting to note that few, if any, successful plantations have been established at any distance from the sea.

Cultivation.

In the case of both nutmegs and cloves, plants are raised from seed in beds under shade. The seedlings are transplanted when about six inches tall. Nutmegs are planted about 30 feet apart, while cloves should not be planted less

than 20 feet apart. Cloves are very sensitive to water at the roots and any possibility of water collecting in puddles round the young plants must be avoided.

Manuring is an important item with both nutmegs and cloves and has always received much attention from keen growers. The usual form of manure in Penang and Province Wellesley is fish refuse but, when obtainable, prawn dust is preferred. This is the refuse from the manufacture of the well-known Malay condiment "belachan." Manure is applied once a year, usually in a trench dug round the tree following the spread of the branches. A favourite practice amongst the Chinese on Bukit Mertajam is to dig a trench two or three times a year and to fill it with cut "lallang" grass.

Clove trees begin to bear when six to seven years old. Nutmegs do not bear until the seventh or eighth year and sometimes later.

Collection and Preparation.

Nutmegs are picked by hand as soon as the fruit splits or is about to do so. They may also be picked with the aid of a forked stick by twisting the fruit off the branches. In Penang and Province Wellesley, where large quantities are rarely handled, the seed is removed from the husk and dried in the sun. The testa or shell is not removed before drying and a nutmeg is said to be dry when the kernel rattles in its shell. The shell is often left intact for export as its removal exposes the kernel to attack by a small beetle. The mace, which is removed with the husk, is dried separately on mats in the sun. When dry it should be flat, horny in texture and of a good colour.

Cloves are picked by hand, but the trees are often of such a height that a light bamboo ladder has to be used to reach the topmost branches. Cloves are fit for gathering when the flower bud begins to assume a reddish colour but before the bud breaks and the small white petals have expanded. The unopened flower buds are then roughly picked over and dried in the sun. The greatest care is necessary in handling the cloves, particularly as they become dry, since the "heads" very easily become detached and not more than 5 per cent. of headless cloves is allowed in a sample of first quality. In a good sample the cloves are large, not too wrinkled and a light purplish brown in colour. Too rapid drying causes them to become shrivelled and brittle. Cloves lose about 70 per cent. of their weight in drying.

Marketing.

In the case of both cloves and nutmegs, the grower usually sells his crop on the tree to a local Chinese dealer who picks, dries and grades the product, and sells to the exporter. The growers appear to be satisfied with existing conditions. The cloves are collected on the land, paid for immediately, if not beforehand, the grower being relieved of the worry of careful drying, sorting and transport to town. Their satisfaction may be due either to the knowledge that they are well served by the dealers, or to conservatism, possibly both. Efforts have been made

from time to time to encourage co-operation amongst the growers with a view to improving their returns but this has met with little success. Nutmegs are valued according to size and are therefore graded according to weight.

No. 1	Grade	gives	60—70	nuts to	the pound.
No. 2	„	„	75—100	„	„
No. 3	„	„	100—150	„	„

Conclusion.

The cultivation of spices on Penang hills and at Bukit Mertajam, which was once a flourishing industry, has dwindled to a few small plantations here and there, chiefly owing to the greater attraction of rubber, and in the case of cloves to the incidence of a stem borer, which causes widespread damage and is difficult to control. The small supplies of nutmegs and cloves which are available are absorbed almost entirely by India. Business with Europe is almost dead, killed by the competition of West Indian nutmegs and mace, and of Zanzibar cloves, although the latter are known to be inferior to those produced in Penang. In 1926 Penang cloves on the London market were fetching 2/6d. per lb. while Zanzibar cloves were only fetching 1/2d. per lb. Uncertainty of the market is a factor which the dealer has to contend with, buyers are often difficult to find even at a low price. The chief demand for cloves is for the Christmas market, this means that there are very few buyers, say, after October. It is a common practice for exporters to buy in April and be unable to sell in London or elsewhere until October. It is a fact, however, that when the price of rubber reaches a low level considerable activity is seen in spice plantations, attention is given to cultivation, manuring, and even planting of young clove bushes to replace some of the very poor rubber trees to be seen on the slopes of Penang hills.

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TWO IMPORTANT PESTS OF THE CLOVE TREE

BY

N. C. E. Miller,

Assistant Entomologist.

The following paper, which is based on observations and reports made by Officers of the Entomological and Field Divisions of the Department of Agriculture, has been prepared with the object of collating all available information regarding two pests; one a beetle, the other a moth, which are said to be responsible for a considerable reduction in the clove crop of Penang Island and Province Wellesley.

In 1923, attempts were made to revive the industry and during inspections of the clove trees the presence of a beetle borer was revealed for the first time by F. Birkinshaw, Agricultural Field Officer, Perak North.

The moth borer which was re-discovered by the writer in 1928 was apparently first noticed by Ridley, who in the Agricultural Bulletin of the Malay Peninsula 1896, when dealing with diseases of the clove tree states:

" At Penara Bukit (Penang) I found a number of clove trees perishing from the attacks of a borer. The borer is a caterpillar of a moth which I hope soon to rear.

It is black with yellow rings, about 1½ inches long and covered with rather sparse long hairs. The caterpillar usually bores into branches, more rarely into the main stem and tunnels up the centre eventually killing the branch. Two or three may occur in one branch. The entrance to the burrow is protected by a web enclosing small pellets or excreta. The pest seemed very destructive, though the Chinese seemed to consider the loss of a few branches of little importance. In several trees they had cut the caterpillar out, evidently recognising the nature of the plague. Hacking the tree about in this way is of course very injurious. The best method of dealing with the animal would be to pass a thin wire up the hole into the burrow and so spear the caterpillar. There is not much difficulty in doing this as the burrow is usually straight and not very long and is quite clear of the excreta, which, as previously mentioned are ejected at the mouth of the hole. The smaller boughs affected should be cut off and burnt."

In 1928, the writer was able to secure a few larvae of this moth, which, judging by their habits, presumably belong to the family Arbelidae. From these larvae he was successful in rearing a few adults, some of which have been submitted to the Imperial Institute of Entomology for determination.*

The presence of a larva is brought to notice by the dark stains and the mass of silken webbing containing a large quantity of drying frass adhering to the affected branch. This webbing conceals the entrance to the burrow and is used by the larva as a protective covering under which to feed. The main food of

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* The identifications of both insects dealt with were received after the paper had gone to press.

The Cerambycid is *Chelidonium brevicorne* Schwarzer. The moth borer, which belongs to the family Xyloryctidae, has been named as *Paralecta antistola* Meyrick.

the larva is bark, and feeding is carried out at night. During the day the larva returns to the burrow, which it would seem, it constructs solely with the idea of providing a safe retreat. The entrance to the burrow is usually situated between the forks of branches measuring from one half to one inch in diameter (Fig. 5).

* The larva (Fig. 1) is black with a pale yellowish stripe on the back of most of the segments and the pupa (Fig. 2) is light-brown and about five-eights of an inch in length.

The adult male moth (Fig. 3) measures one and a half inches across the wings and is entirely sooty brown, except for a pale greyish transverse band along the inner half of the forewings.

The female moth (Fig. 4) is entirely whitish with a faint pinkish tinge and iridescence. On the forewings there is a central brown spot and a brownish shading at the tips. The hindwings are rather strongly shaded with brown. Across the wings it measures two inches.

Attempts to rear the larvae were not very successful, and the sole information obtained regarding its life cycle is that the pupal period lasts for twenty-one days.

The boring habits of this species bring about die-back and also, as vacant bore holes are capable of holding rain water, decay sets in lower down.

The grub of the beetle borer (Fig. 6) was first brought to light in January, 1924, by B. A. R. Gater, late Assistant Entomologist, Department of Agriculture, S.S. and F.M.S., who undertook the initial investigations.

In the same year, he carried out control experiments, consisting of the injection into the bore hole of various chemicals. Artificial bore holes were also made in healthy trees, in order to ascertain whether any deleterious effects were produced by the injection of the chemicals employed.

According to Gater, the time taken for a complete life cycle from egg to adult is about a year, the egg being probably laid in May and pupation taking

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* 1. Description of larva.

Head black, glabrous: strongly punctate; labrum and antennae pale shining brown. Thoracic segments blackish brown; prothoracic shield dark shining brown, with a faint median longitudinal pale brown stripe; meso and meta thorax with shining light brown chitinized patches; metathorax with a narrow transverse ochreous band dorsally.

Abdominal segments 1—7 light purplish brown with an ochreous band along the anterior margin dorsally, behind which is a chitinized shining brownish patch; abdominal segment 8 with an ochreous band only; segments 9—10 blackish brown; segments 1—7 with irregular shining brown chitinized patches laterally. Head and body with scattered setae and with a seta above each spiracle. Thoracic legs shining brown. Abdominal legs with the crochets pinkish.

Description of pupa.

Pupa 15 mm. Region of head dark brown, becoming paler towards elytra; ventral surface pale yellowish brown. Ventral segments with an undulate ridge of spines which hardly reach the spiracles on segments 1 and 2, and completely encircle the segment in segments 3—6. Surface of head region finely tuberculate and with four large tubercles each bearing a seta which is curved forward to about half its length. Prothorax with four pairs of setae: sides of head with a strongly chitinized process; spines on segments 1 and 2 of abdomen acute, on remaining segments short and rounded apically (N.C.E.M.)

FIG. 1. LARVA OF MOTH BORER.
NATURAL SIZE $\frac{3}{4}$''.

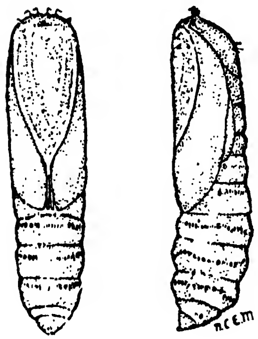

FIG. 2. PUPAE OF MOTH BORER.
NATURAL SIZE $\frac{3}{4}$''.

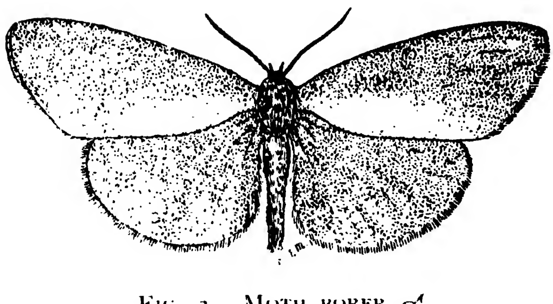

FIG. 3. MOTH BORER ♂
NATURAL SIZE $1\frac{1}{2}$''.

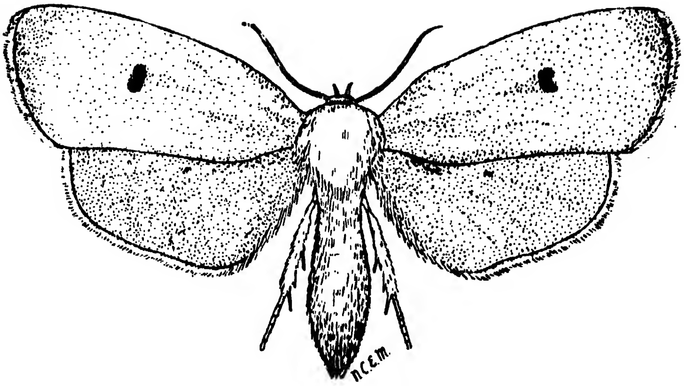

FIG. 4. MOTH BORER ♂ NATURAL SIZE 2".

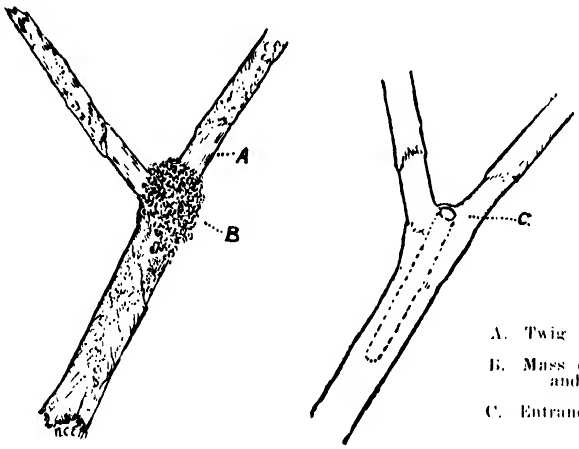

FIG. 5. CLOVE BRANCH SHEWING DAMAGE CAUSED BY MOTH BORER.

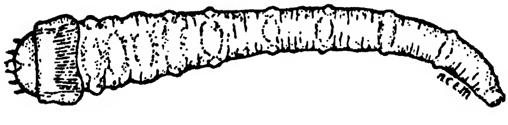

FIG. 6. GRUB OF CERAMBYCID.

K. P. & CO., LTD.

place about February.

The grub of this beetle is dirty white, cylindrical with the anterior part of the body—i.e. that part nearest the head much enlarged. For this reason grubs of these beetles are sometimes known as " roundheaded borers."†

Six chemicals, namely dichlorobenzene, tetrachlorethane, dinitronaphthalene, tetra hydronaphthalene, creosote-chloroform mixture, and trichlorethylene were used by Gater, with apparently no deleterious effect on the trees. Grubs, however, in every instance were killed by these injections.

Control methods practised by the cultivators were clumsy and liable to cause considerable damage to the trees. The method adopted by them consisted of cutting away a portion of the tree around the bore hole and extracting the grub by means of a piece of wire bent at the end. It is obvious that irreparable damage may be inflicted in this manner.

The clove areas at Bukit Mertajam, Province Wellesley and at Balik Pulau and Teluk Bahang, Penang, were inspected by C. Dover, late acting Assistant Entomologist and F. R. Mason, Agricultural Field Officer, in June, 1927.

The conclusions arrived at by those officers were that, while it would seem that little or no harm can result from the injection of chemicals, it is essential that adequate precautions be taken to inhibit further infestation of the trees by borers.

These areas were visited by J. W. Jolly, Agricultural Field Officer and the writer in May, 1828, but extended observations could not be carried out. At that time, the plantations were in a neglected state, and the ground was littered in places with dead branches. Dead clove trees had also been left standing. Larvae of the Cerambycid and of the Arbelid were found, but the former did not survive under laboratory conditions. Recommendations for control additional to those made by previous investigators, were not then made, for it was considered that until more complete information regarding the life history and possible alternative host plants of the insect were obtained, little progress could be made towards control.

Judging by the egg laying habits of other Cerambycidae it would seem that this species also lays its eggs on or just under the bark of the host tree. Therefore, the main object of any control measure should be to prevent egg laying. This could most probably be effected by treating the trunks and lower branches with a wash composed of whale oil and crude carbolic acid. Wrapping the trunks

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† *Description of Grub*. Whitish ochraceous. Prothoracic shield pale brownish ochraceous in anterior half and laterally, whitish with a faint violaceous suffusion in posterior half; anterior half fairly thickly covered with short rather robust brownish setae, some arising from low tubercles. Head whitish ochraceous; Clypeus and anterior area of genae brownish ochraceous; mandibles piceous; palps and antennae dark brownish ochraceous. Thoracic and abdominal segments sparsely covered with short brownish setae, but smooth dorsally and ventrally except prosternum which is feebly setose. Thoracic legs brown. Spiracles light brown; posterior half prothoracic shield longitudinally striate. (N.C.E.M.)

with sacking treated in this way would probably be equally if not more effective, and would certainly tend to retain the solution for a longer period.

The destruction of larvae by chemical means can only be considered a temporary measure and until accurate information is obtained as to the extent to which trees will withstand the action of chemicals injected into them and the degree to which bearing is affected, prevention of infestation should be aimed at, after destruction of larvae already in the trees.

The question of damage to the clove trees in the same area was again considered in July, 1930, and visits of inspection were made by H. T. Pagden, Assistant Entomologist and F. R. Mason, Agricultural Field Officer.

In the report made subsequently, Pagden states that as far as he is able to ascertain, the Cerambycid borer has almost completely destroyed the clove industry at Bukit Mertajam.

In this area, the cultivators have given preference to rubber growing, and also have not replaced clove trees which have died as the result of borer attack and of the crude methods for control previously referred to in the present paper.

Pagden concludes that he is led to suppose that only trees which have reached a certain diameter are attacked by the Cerambycid, and " that careful attention to cultivation, pruning and the use of a deterrent wash in areas recently planted should eliminate damage by this pest."

In a later report he outlines the ideas held by Chinese clove growers with respect to the habits of the Cerambycid and the period during which attempts at control are practised.

A Chinese questioned on this subject stated that inspection is carried out between the " 5th to the 10th month," * since it is believed that it is during those months only, that the larva is to be found. The adult beetle was stated to bore a hole into the tree and enter this for the purpose of reproduction, but this procedure had not been observed. What happened after this would appear to be somewhat indefinite, the adult beetle either turning into a larva, or laying eggs in the tunnel it had previously bored. In the opinion of Pagden the Chinese would appear to believe the former since they do not seem to associate the smaller larvae with the larger. Other cultivators are inclined to the belief that the borers owe their origin to spontaneous creation.

Regarding the application of tar to cut surfaces where branches have been sawn off, the objection has been raised that this prevents the wound from drying quickly. According to Pagden's observations, however, this is wrong, as all cut and untreated surfaces examined by him were seen to be attacked either by termites or by ants which make nesting galleries and possibly cultivate fungi.

In conclusion, pending detailed investigation into the ecology of the two pests, steps should be taken immediately to carry out the recommendations made by various officers.

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* Chinese Calendar.

These recommendations may be summarised as follows :—

(1) Careful pruning. Cutting off smaller infested boughs. (i.e. those infested by the Arbelid).

(2) Treating all cut surfaces with tar, or some similar substance.

(3) Destroying larvae by injection of chemicals into the bore holes.

(4) Prevention of infestation by the application of washes.

The importance of co-operation in the practice of control measures should be stressed on all occasions.

PREPARATION OF SHEET RUBBER

BY

R. O. Bishop, M.B.E., F.I.C.

Acting Head of Chemical Division,
Rubber Research Institute of Malaya.

The preparation of sheet rubber has already been the subject of such a mass of literature that the publication of an article with the above title demands an explanatory foreword.

On account of the somewhat catastrophic changes which have recently occurred in the plantation industry, and the consequent readjustment of previously accepted standards, it is essential to be sure of the basic facts governing the manufacture of plantation products and therefore, even at the risk of reiteration, those responsible for future progress must make certain that principles are clearly defined.

The plantation in bearing is a factory and the manager is a manufacturer who must continually bear in mind the salutary fact that ultimate success depends on the quantity, quality and cost price of the product which he *sells.* It may be obvious, but it appears to be opportune to remind ourselves, that the reputation and livelihood of the dairyman depends upon the quantity and quality of the milk he sells and not on the size and vigour of his herd.

To ensure sales our product must conform to market requirements. It is with a view to balancing total sales against total cost of production that our plantation factories must be governed. The F.O.B. of a portion of the crop is of little significance in the economic structure of the whole plantation.

In the past the grower had the advantage. That which he chose to prepare the market was obliged to accept. In the course of time, however, the standards governing the preparation of plantation rubber have been gradually changed to meet the more pressing demands of the consumer, and at the present condition of the market the care and attention required to prepare Singapore Standard Quality sheet demands efficient and experienced supervision.

With increasing production and enhanced competition it is obvious that present methods and standards will be superseded and the preparation of plantation rubber will develop into a technical manufacturing process.

A time will come when the quality of plantation rubber will be judged by more scientific methods than those in fashion now and criteria based on the ultimate application of the commodity will regulate the estate plantation manufacturing process. For the present and immediate future, however, it is the Singapore Standard which is the real criterion and therefore it is by this standard that we sellers must fashion our product.

Singapore Standard Quality demands that " Standard ribbed sheet rubber shall be clean, tough rubber, free from bark or sand, from dampness, under or

over smoked or massed sheets." Our object must be to adapt our method of manufacture to fulfilling these requirements with the greatest economy.

The preparation of sheet rubber may be considered in four stages: viz., Collection of latex; coagulation; handling coagulum, and drying and packing.

Latex Collection.

Immediately latex exudes from the freshly opened cut there is a natural tendency for it to collect dirt and undergo change. Contamination commences at the tapping cut from the micro-organisms present in the air and on the tree and the small pieces of bark and vegetable tissues which have been washed down the cut by the latex and also particles of soil which were adhering to the tapping panel. There may be vegetable waste and soil in the tapping cup, also pieces of old partially putrefied rubber from the previous day's tapping. Under the present methods of tapping and collecting latex much of this contamination is unavoidable, but there is some which, even by present standards, is inexcusable.

In order to obviate unnecessary difficulties in cleaning the latex it is advised that precautions should be taken to prevent as much contamination of the latex as possible while it is flowing down the cut and collecting in the cup. It is realised that the sand and other forms of dirt can be removed subsequently but there is no reason why latex with a reasonable degree of cleanliness should not be collected, and the frequent sight of dirty cups which one meets in this country even on first class estates is a sad reflection on the attitude of mind of those responsible for the quality of plantation rubber.

When the cups are collected the tappers should also bear in mind the need for maintaining cleanliness and, although the system of wet collection which was practised some time ago is considered to be unnecessary, it is felt that recently washed buckets provided with well fitting lids are an undoubted advantage.

The use of a preservative in the field is open to much discussion and undoubtedly the field use of a chemical is difficult to control under ordinary routine conditions of tapping. If latex is collected early and cups and other vessels are kept reasonably clean there is little doubt that the use of a preservative in the cups is not essential. When the preservative should be added is into the tappers' buckets when the collection is to take place.

The Information Cards published by the Rubber Research Institute give particulars of the amount of sodium sulphite normally used. It is not considered that these proportions are absolutely infallible, however, and the estate manager should realise the necessity for carrying out his own trials from time to time to ensure the most economic and efficient use of preservative.

One frequently learns in dealing with estate queries that the appearance and quality of the sheet has suddenly changed. The manager will state that no alteration whatever has been made in his procedure and the use of preservative has remained unchanged; yet fate has suddenly dealt a cruel blow in the alteration of the appearance of his product. It must be realised that the rubber tree, like every other living organism, is subject to natural variations and these

variations will be reflected in the composition and behavour of the latex; therefore, it is little wonder that a practice which has been found satisfactory at one time will, without doubt, need revising as the seasons change and the tree adjusts its metabolism. For this reason frequent periodic tests must be carried out so that the process of sheet manufacturing can be adjusted to meet the latex variations.

Latex Handling.

When the latex arrives at the factory, whether it has been transported in the tappers' buckets or in a collection cart, means should be provided for checking the quantity, strength and stability of the latex received, with suitable provision for handling the crop without delay. Strict uniformity in the procedure of crop reception and handling should be enforced with meticulous care.

Immediately the latex has been received at the factory, a sample should be drawn to see that it is satisfactorily preserved, and on the results of this sampling sufficient preservative can be added, if necessary, to allow for subsequent handling of the latex.

At the present time there is little doubt that particular attention is being paid by the market to the presence of sand and specks in sheet. The Rubber Research Institute has carried out sufficient work on this problem to be able to state very definitely the means whereby latex can be satisfactorily cleaned to make sheet rubber which will be entirely free from sand and specks. The cleaning cannot be effected by sieving alone, that is absolutely definite. Although there are many estates which have never yet resorted to settling diluted latex before passing it to the coagulating tanks and estates which continue to get standard prices for their sheet prepared from latex which has suffered only a very sketchy form of sieving, yet the Institute is fully convinced that such a state of affairs will not endure and future practice will necessitate a satisfactory cleaning of the latex before coagulation takes place.

Latex can only be cleaned satisfactorily by settling. When field latex is received it contains so much rubber—4 lbs. and more per gallon—that it is viscous and thick, therefore, any particles of sand or bark which happen to be present are prevented from separating. Separation can, however, be effected by a short period of settling if the viscosity of the latex is reduced with water. This can be accomplished in the factory by the use of settling tanks. In some cases old wooden coagulating tanks have been converted to this purpose. If sufficient money is available it is preferable to build suitably designed settling tanks of concrete, lined with tiles, or to purchase aluminium tanks. The tank should be constructed with an outlet near the bottom from which the latex can be run off without disturbing the separated sediment. If a quarter of an inch clearance is allowed between the outlet and the bottom of the tank, this will provide sufficient room in which the sediment can collect and remain undisturbed when the latex is run out.

The field latex should be poured into the settling tank through a coarse strainer, 40 holes to the inch, an ample supply of water being directed on to the

bottom of the sieve to obviate the necessity for manual assistance. The diluted latex will readily pass through the holes of the sieve and the coarse debris will be eliminated. The latex and water should be mixed in the settling tank so that the dry rubber content of the total bulk should not be more than a 2 lbs. of rubber to the gallon. The viscosity of this diluted latex will be sufficiently reduced to allow free separation of the light particles of barky material. These will rise to the surface and any particles of sand will settle to the bottom. When the diluted latex has been allowed to settle for ten minutes the contents of the settling tank should be very carefully skimmed. For this purpose a fine mesh sieve should be used—one having 100 holes to an inch would be preferable.

The skimmed latex should be run slowly from the settling tank to the coagulating tank, if necessary through an 80 mesh sieve in order to eliminate any small particles of scum or floating debris which have escaped the skimming. At this stage care should be taken to prevent the latex from running off too quickly or dropping too far in the course of its flow.

Frothing is very liable to occur in latex and the bubbles of air enclosed may eventually lead to defective sheet, besides hampering the rapid working of the factory.

Coagulation.

Coagulation of the standardised latex needs little comment. The proportion of acid to be used and the dilution recommended have been repeatedly specified. At the present time the Information Cards issued by the Institute set out in a concise manner the proportion of coagulant recommended for a variety of latex concentrations destined for sheet manufacture on the same day or on the following day.

A word about coagulating vessels would not be out of place. There is a tendency on the part of those responsible for the management of estate practice to overlook the organic nature of the fluid which they are handling. Latex is similar to milk and the behaviour of the two fluids bears a striking resemblance in many respects. The dairyman knows full well that his product will suffer unless the utensils he uses are maintained in a state of scrupulous cleanliness. At the present time the plantation factory is not required to conform to bye-laws established by a Department of Hygiene and the degree of cleanliness essential in handling milk is not legally enforced for latex. Nevertheless, if we are to prepare a reasonably uniform product, free from defects penalised by the market, we must pay attention to cleanliness in the factory and guard against all sources of contamination and putrefaction.

The use of aluminium coagulating tanks and other factory utensils assists in maintaining such cleanliness, but where aluminium is too costly it does not follow that we should relinquish our care. Wooden tanks can be kept perfectly sweet and clean. Tanks and their wooden partitions should be washed with clean water after each coagulation and then dried before being filled with latex again. Where a factory is called upon to handle an increasing crop it is sometimes found

that the limited capacity of the coagulating plant entirely prevents any effective cleaning and drying of the tanks from one day to the next. This invariably leads to trouble, for it is humanly impossible to maintain tanks and partitions in a satisfactory state of cleanliness if they are in constant and continuous use. There must be an adequate capacity to allow each tank to be thoroughly cleaned and dried at regular intervals. Where tanks have already become sour, and bubbles in the sheet will very soon draw attention to this, drastic steps must be taken to eliminate all the putrefactive organisms which have developed in the pores of the wood. Boiling with water to which a little para-nitrophenol has been added will be found most effective but scouring with other types of bactericides and subsequent drying will also serve. As it is becoming increasingly common for the crop to outgrow the capacity of the factory plant, troubles which arise from inadequate cleaning are becoming more prevalent.

The crop capacity of coagulating tanks depends on the concentration of the latex at the time of coagulation and it may not be out of place to remind those who are still struggling through each day's crop in the form of latex diluted to 1¼ lbs. dry rubber content per gallon that latex containing 2 lbs. dry rubber per gallon is being handled daily in more than one factory which is never awarded less than Singapore standard for its sheet. The treatment of the more diluted latex is possibly more fool-proof and that is probably why estates still continue to dilute their latex to such an unnecessary extent, but when one considers that the adoption of "two pound" latex increases the tank capacity by sixty per cent. without increasing the work, one marvels that the burden of inadequate tank capacity is ever tolerated.

Handling the Coagulum.

The manufacture of a satisfactory sheet from clean latex depends also for its success upon the handling of the coagulum. When the coagulation is completed the coagulum should be sufficiently soft and plastic to respond readily to even machining. A condition of affairs exists in many factories which is inimical to the successful handling of the soft plastic mass from the coagulating tank and its transporatation to the sheeting battery. It is a matter of supreme importance to efficient manufacture to decide the optimum point at which the coagulum can be safely lifted and handled and yet be suitable for easy machining.

Recent developments in one of the large and up-to-date sheeting factories have shown the desirability of inserting a carrier or chute between the coagulating tank and the first machine. A simple device which has been found suitable is an aluminium trough of the same width as the coagulum, arranged on an incline to the first machine. A stream of water is maintained flowing down the trough. The pieces of coagulum when lifted from the tank to the trough slide unaided into the machine. By this means a soft and yielding coagulum can be successfully brought to a sufficiently compressed state to allow it to be handled by the machine cooly. Unless the coagulum is plastic and soft the rolled sheet will have thick edges and drying and smoking of the sheet will be delayed. When the sheet dries unevenly

it means that the coagulum has not been handled satisfactorily and experience shows that this is a fault which arises between the coagulating tank and the first machine and one that can be overcome by improved supervision.

The setting of the machine rolls depends to a great extent on the personal skill of the operator, but in view of its importance to the properties of the sheet every precaution should be taken to render this operation as fool-proof as possible. It must be remembered that one of the main objects of rolling the coagulum is to remove the serum, and unless the sheet is machined evenly and efficiently with simultaneous washing the tendency to defects such as rust, discoloured patches and mould will be increased.

The output of sheeting batteries has been made the subject of investigation by the Institute, and the results to date will be recorded in the next number of the Institute's Journal. The fact that some estate factories with three smooth machines and one marker with only one operator to each machine are now obtaining routine outputs of approximately 1300 lbs. dry sheet per hour indicates the economy to be derived from handling a wide sheet.

It is impossible for every factory with present facilities to develop an output of such magnitude, but the answers to a questionnaire addressed to a number of estates discloses a state of efficiency very far from ideal for much of the sheeting plant now in use.

The capacity of a machine depends on the width and thickness of the sheet treated and the number of feet of rubber rolled in a given time. It is doubtful whether such facts receive proper consideration. Apart entirely from the possible economy to be effected by running the available plant to full load, the appearance of the sheet and its freedom from many blemishes depends on the care and efficiency with which the sheeting is accomplished.

Drying and Packing.

One of the most important uses, and according to history the original use for which rubber was introduced to Europe, depends upon its characteristic of forming a waterproof surface. This characterisic should not be overlooked when we consider problems relating to the drying of sheet rubber.

When coagulum is compressed into sheet form we enclose water in a film of rubber and our ability to dry the sheet depends upon the efficiency with which we can withdraw the water from its waterproof jacket. For this reason the handling of coagulum and wet sheet should be undertaken with a view to retaining a porous or water permeable surface. It is the practice on almost all estates to drain the wet sheet before hanging it in the smokehouse. This draining should be carried out at a temperature which will not unduly harden the surface of the rubber and the removal of serum and serum solids by efficient washing should be regarded as a means to assist the ultimate removal of water, because it is known that the serum constituents of latex if allowed to remain in the sheet reduce the ease with which the water can be removed from warm rubber.

In the smokehouse itself cleanliness must not be forgotten. Having paid particular care to removing dirt from the latex and handling the coagulum under clean conditions it seems illogical to place the rubber in a building where little heed is paid to contamination with dust. In present estate practice it is very uncommon to dry rubber by means which exclude the undesirable products of combustion from entering the drying chamber. Much may be done on some estates to remove ash and dust before the hot gases gain access to the hanging sheet. This is a point where constant care and attention is required if unnecessary cleaning and cutting of the sheet afterwards is to be avoided.

The drying efficiency of a building depends upon the volume of air passing through the building and the difference in temperature between the incoming and the outgoing currents. It is important that the estate manager should make certain that full advantage is being taken of the space available by carrying out continuous observations on these points.

When the sheet has been dried and removed from the smokehouse it is necessary to sort, classify and pack it without delay. If due regard has been paid to the supervision of each stage of manufacture the sorting of sheet should be a mere matter of form; it is difficult to see what requires to be cut out of a finished sheet which has been made from clean latex handled throughout in a clean plant. On account of the introduction of accidental blemishes, however, sorting is always desirable, and this sorting should be carried out with the object of segregating all sheet which will not conform to market standards.

The value of a consignment depends upon the most inferior sheet in the lot and, although it sounds an exaggeration, there is every justification for penalising a consignment which contains one or two inferior sheets. A tyre is judged by the strength of its weakest spot, and it is useless for a manufacturer to rely upon the suitability of a parcel for tube manufacture if his somewhat rapid method of sampling discloses one portion of unsatisfactory rubber. The tube manufacturer finds that he cannot eliminate some kinds of dirt from rubber with any degree of reliability and consequently he penalises the whole consignment.

Packing should be resorted to as soon as possible in order to avoid any contamination of the finished material. Sheet which has been well prepared and carefully handled is still liable to develop defects if it is allowed to remain exposed to the moist air of the tropics, and although a consignment cannot be immediately marketed it is desirable to remove it from contamination at the earliest opportunity.

Conclusion.

The above indicates in a brief manner some of the outstanding points which should be observed by those interested in the preparation of standard sheet rubber of high quality at the present time. Factory practice is undergoing rapid and continuous changes. Undoubtedly a time will arise when the engineer and the chemist will have succeeded in transforming the old familiar estate factories into up-to-date establishments of modern machinery, but whether the plant of the

future will be driven electrically and succeed in producing a perfect sheet of rubber continuously in a few hours from the time the latex is received, or whether the latex will be transformed directly into completely finished rubber articles, the fundamentals will remain the same and the success of the operation will depend upon cleanliness and care; and whatever future developments may occur in the preparation of estate rubber for the market it is vital for the producer to remember that when any product is in excess of requirements the consumer sets the standard of quality. Non-conformity with such standards simply means no sales.

MINERALS AND NUTRITION

BY

Lt. Colonel H. A. Reid, O.B.E., F.R.C.V.S., D.V.H., F.R.S.E.

The influence of nutrition in preserving the health of the body has long been recognised. It had been observed that impoverishment from whatever cause increases susceptibilty to disease, and that both parasitic and microbic infections single out as their victims the poorly nourished.

The subject of nutrition was originally regarded solely from the aspect of digestion and assimilation. The body was assumed to be analogous to an engine which required so much combustible material for purposes of oxydation, and the aim was to adjust the amount of food to the energy requirements of the individual. A well balanced diet was one which contained an appropriate supply of proximate principles of definite caloric value. Although analysts of the early nineteenth century had turned their attention to the ash constituents of plants in relation to nutrition it is only in comparatively recent times that the vital importance of this aspect of the question has received serious consideration.

The study of certain hypothetical constituents known as accessory food factors, or vitamins as they have come to be known, has demonstrated that chemical analysis does not determine the actual nutritive value of foodstuffs. There are intangible properties which may not be revealed but which nevertheless are of extreme importance to the well being of the living organism. The fact that the human subject can maintain for an indefinite period vigorous health by the consumption of fruit juices alone, indicates that there are substances present which cannot be estimated in terms of heat units. It has recently been reported that sheep which had access to oranges maintained far better condition than others fed in the ordinary way.

It has been realised of late that the inorganic elements of foodstuffs are of as much importance as the organic constituents. Absence or insufficiency of certain mineral salts in an assimilable form is the cause of the so-called deficiency diseases which prevail in certain countries or localities throughout the world. It is doubtful even now whether the significance of an adequate mineral content is universally recognised by dieteticians. Yet in countries where the origin of obscure pathological conditions has been carefully investigated, these, in many instances, have been found to depend upon soil and hence plant deficiency in one or other of the mineral salts.

The valuable work accomplished by bacteriologists in determining the immediate cause of disease has, to a large extent, overshadowed the equally important though more remote question of nutrition in relation to susceptibility. We have to realise that a tissue immunity is dependent upon metabolic activity which will ensure an adequate supply of inorganic elements to the tissues and body fluids.

The observation that grazing animals will normally seek and devour those portions of the pasture richest in minerals illustrates the possession of an instinctive desire to absorb mineral matter and a recognition on their part that pastures

low in minerals are generally deficient also in protein. It is interesting to note that verminous infestations are frequent among livestock on mineral deficient pastures.

It is not unreasonable to assume that the beneficial effects of water from certain sources is probably due to their mineral content in solution which supplies essential elements to those who derive benefit from "cures" undertaken at spas. The universal desire for table salt suggests that sodium and chlorine may be deficient in the ordinary regimen of the human subject. It has been observed too, that cattle where "pica" and brittle bone diseases are prevalent develop the habit of licking themselves and their fellows apparently to obtain salt present in the skin excretions. Urine sodden earth may also be consumed, doubtless from the same motives.

The contention that salt acts as a hormone to the secretion of hydrochloric acid in the digestive juices is not supported by experimental evidence. Deprivation of salt merely leads to a conservation of sodium chloride obtainable from foodstuffs accompanied by a lowered excretion of sodium and chlorine without influencing the amount of hydrochloric acid present in the stomach.

The above premises lead us to the consideration of the more important mineral elements indispensable to nutrition. Chief among these must be placed calcium and phosphorus. These are present in all vegetation although their distribution is irregular, corresponding with the species of plant constituting the pasture and the nature of the soil upon which it is grown. Legumes are richer in minerals than grasses, while, on the other hand, grasses contain more phosphorus though less calcium than the legumes. It is important therefore, from a practical point of view, to see that the proportion of grass to clover is maintained more especially since clover always tends to displace grass. The modern European practice of feeding concentrates to dairy cattle is open to the objection that these vegetable concentrates contain an excess of phosphoric acid over the lime, and as these salts combine disproportionately to form bone, the excess of phosphoric acid tends to denude the body of its calcium.

In those countries or localities where a notable deficiency of phosphorus occurs livestock are frequently subject to the development of abnormalities proceeding from this cause. In South Africa, Theiler and his colleagues have traced a number of deficiency diseases affecting principally the bones, to this source, and similar observations have been recorded elsewhere. In India, New Zealand, and Australia, calcium and phosphorus deficiencies account for many obvious abnormalities occurring among grazing stock and may probably be responsible for others which are not so strikingly visible. In the last named country, Sedden in New South Wales has observed that ruminants depastured on phosphorus deficient land, are prone to consume the carcasses of dead animals and in this way they get infected with *Bacillus botulinus* and die from an acute toxaemia accompanied by paralytic symptoms. In order to maintain the calcium equilibrium of the blood and soft tissues, the lime salts, in the event of a calcium deficiency in the food supply, are absorbed from the skeleton. In consequence,

complaints denoted by fragility and deformation of the bones occur. Osteomalacia is frequent among sheep kept under these conditions, and the disease known as Osteoporosis of equines appears also to depend primarily upon a calcium-phosphoric acid deficiency.

Climatic conditions materially affect the mineral content of herbage. Thus in arid regions or during prolonged periods of drought the percentage of phosphorus is lower, and conversely, the lime content tends to be higher. This seasonal variation in the amount of the mineral salts present in the herbage explains to some extent the prevalence of nutritional diseases in certain countries or localities.

The application of fertilisers to poor land has the effect of diminishing the loss of minerals and at the same time conserving the soil moisture. In experimental plots treated with various fertilisers it is noticeable that the treated plots by comparison with the controls or untreated portions remain in better heart and keep greener during prolonged periods of dry weather.

India and parts of Australia from whence animal products including bone manure have been exported, have become notoriously poor in those mineral elements which have been extracted from the soil through generations of grazing. In countries whose commerce largely consists in the exportation of products derived from animals, the necessity to replace the loss of mineral matter by the application of suitable fertilisers is often neglected. In consequence, the livestock, although they may not show definite signs of suffering from this deficiency, sooner or later gradually decline in size and stamina and their development is retarded. This appears to be a natural attempt to limit their absorption of mineral salts through the assertion of the law of rapid development demanding an abundance of nutritive elements. Where pedigree stock have been introduced into countries with the object of grading up native herds, these retrogressive characters are very noticeable. The progeny resulting from the mating of the imported stock with the indigenous species fail, after a time, to thrive and are more susceptible to disease. They have, in fact, inherited the physical attributes of the imported parent without the advantage of an adequate food supply containing the due proportion of mineral matter necessary for the larger and more rapid development resulting from the cross.

In the Border Counties of England and Scotland a wasting disease known locally as " pining " or " vinquish " is prevalent among sheep, and a similar if not identical disorder occurs in certain areas of the north island of New Zealand where it affects both cattle and sheep. For many years the nature of this malady baffled those engaged in the work of investigation until an exhaustive comparative analysis of the soil and herbage from affected and healthy country revealed a shortage in the former of soluble iron.

" Bush Disease," as it is termed in New Zealand, appears on land of volcanic origin which is largely composed of pumice and the débris of lava. Iron is present in the form of an insoluble silicate which renders it unavailable for plant life. Ruminants grazing on such land consequently become affected with a

progressive anaemia causing them to waste away and finally succumb often amidst a luxuriant growth of pasture. In the earlier stages of the trouble a cure can be effected by the administration of a soluble salt of iron such as the double citrate of iron and ammonium. Cultivation and the application of phosphatic manures assist in eliminating the disease from the affected territory. Young stock can be fattened on 'bush sick' land but they cannot be maintained there for more than a few months without a change to healthy country. Another similar complaint is met with in East Africa under the name "Nakuruities" from the district where it exists. It has probably the same etiology as the New Zealand disease—absence of iron in an assimilable form. It is interesting in this connection to note that recent work has demonstrated the importance of copper in haemoglobin synthesis. In the absence of copper anaemic conditions are liable to occur. Copper is found principally in the liver. The investigations in New Zealand did not determine any insufficiency of copper in the viscera of even advanced cases of the iron hunger complaint.

An explanation of the immunity enjoyed by horses grazed on land short of iron and certainly fatal to ruminants may be found in their slower development rendering their need for mineral salt absorption less urgent.

Among the most interesting of the inorganic elements concerned in nutrition iodine occupies a prominent place. Iodine is present in all herbage in fractional amounts which may be so minute that refined methods of chemical analysis have to be employed in estimating the iodine content of pastures, hay, and other animal foodstuffs. The amount varies, corresponding with the iodine content of the soil.

Although the normal requirements for iodine appear to be very low, a deficiency gives rise to profound pathological changes chiefly connected with the functions of the thyroid gland which is the iodine storehouse of the body. Thyroxin, a secretion of the thyroid gland, contains normally 66 per cent. of iodine. The grave effects following on iodine shortage are witnessed in various parts of the world, notably in certain States of America, Canada, Australia, New Zealand, Africa, Palestine, and many parts of India. Mexico, Brazil, and the Argentine also suffer in this respect.

In iodine deficient countries both human beings and animals are liable to develop goitre and its concommitants denoted by general unthriftiness, hairlessness, and a tendency to malformation of the progeny of the iodine starved parent stock. But the development of diseases dependent upon thyroid insufficiency is by no means the only influence which this element exercises. It is also concerned, probably through its action on the parathyroids, with the body metabolism, which determines the equilibrium of blood phosphorus, nitrogen, and calcium. Livestock which do not obtain an adequate amount of iodine are less resistant to infections and intoxications of all kinds. Their productivity is lowered and they become generally less profitable.

The natural distribution of iodine is very erratic. Some districts are by comparison richly supplied, while in others there may be little or none. More-

over, cultivation and the application of artificial fertilisers and even animal excreta tend in time to exhaust the iodine content of the soil.

In all the older cultivated countries, as well as in many of those more recently developed, there is probably an iodine shortage which though not in itself sufficient to produce gross pathological changes, is nevertheless responsible for some of the obscure conditions met with in relation to grazing stock, such as partial or complete sterility, malnutrition, and lowered vital resistance. Most urban populations suffer from iodine deficiency through the almost universal habit of consuming only cooked food.

The ultra-violet rays of sunlight are known to promote the absorption of the mineral elements from food, especially calcium and phosphorus, and similar properties are attributed to vitamin "D" found in cod-liver oil. Iodine also shares in calcium and phosphorus metabolism, and it is quite likely that the iodine content of cod-liver oil influences mineral absorption in this way.

It follows from the preceding remarks that all cases of obscure origin occurring among animals at pasture should be investigated from the point of view of mineral assimilation and that analyses of the soil and herbage should be undertaken as a routine procedure. Iodine incorporated in mineral licks, or, according to circumstances, administered individually as potassium iodine, may be regarded as frequently helpful. The application of the iodiferous Chilean nitrate of soda as a fertiliser likewise suggests a practical procedure in cases suspected to depend upon an iodine shortage in the soil or foodstuffs of the locality.

Abstracts.

PROGRESS REPORT OF THE RICE CULTIVATION COMMITTEE OF MALAYA.

The following is an Abstract of the Progress Report of the above Committee which was published in the local press in November, 1930. The Committee was appointed by H. E. The Governor for the purpose of collecting evidence concerning the present position of the rice growing industry in Malaya and to make recommendations regarding future policy in local rice production. The Director of Agriculture is Chairman of the Committee.

In examining the present position of rice production in Malaya all the principal rice growing areas have been visited and a number of witnesses, up to date amounting to 90, have been examined.

It is the view of the Committee that it is impossible to put forward reliable recommendations until the situation throughout Malaya has been thoroughly examined. The conclusions summarised hereunder must therefore be regarded as tentative.

No very definite policy has hitherto been adopted in Malaya concerning local rice production. Two schools of thought on the subject may be said to have existed. The first maintained that the prosperity of Malaya depended on the cultivation and production of export staples and that, while reasonable help and encouragement should be forthcoming for rice cultivators, rice cultivation was of comparatively small importance to the country inasmuch as with a satisfactory market price for export staples, the country had always been in a position to purchase supplies required from outside on more favourable terms than those on which they could be produced in Malaya. The second held that the domestic food supply was of vital importance to the country and that dependence on imported supplies of rice was a source of danger, as in the event of an acute fall in the price of export staples or a shortage in the available export excedent of rice in foreign countries or both, a grave crisis might quickly arise. This condition actually arose during the rice shortage of 1919—21 and in order to cope with this the Government sustained a loss of forty-two million dollars, while further losses to employers must have been considerable. At the present time the slump is similarly affording a demonstration of the truth of this point of view.

The general distress resulting from existing economic conditions does not extend to those areas and to those communities which produce sufficient rice to meet their requirements.

It is agreed that in favourable years pecuniary profits resulting from rice cultivation are lower than those obtained from the cultivation of such crops as rubber and coconuts, but it must be remembered that little has been done to encourage the cultivation of rice, to improve its production or to enhance the possibilities of gain therefrom. In these circumstances it is desirable that all possible steps should be taken to improve matters so that when the market improves for export staples, rice cultivation may be maintained in competition therewith under better conditions than have hitherto obtained.

The following is a summarised statement of the findings of the Committee up to the present time.

1. The cultivation of padi is almost entirely in the hands of Malays, the average size of holding varying between 2—7 acres.
2. Statistics of areas are more reliable than those concerning crops. The following figures can therefore only be accepted as approximate—
   Straits Settlements 68,000 acres yielding 20,690,000 gantangs of padi;
   Federated Malay States 171,400 acres yielding 32,500,00 gantangs of padi;
   Unfederated Malay States 412,000 acres yielding 83,300,000 gantangs of padi.
3. In order to afford a sound basis for improving the industry, more accurate statistics concerning production are essential. It is noted that steps in this direction are already being taken.
4. Figures of yield are unreliable, there being a universal tendency to understate yields. In consequence it is impossible to gauge the effects of any measures that have been undertaken for the improvement of padi cultivation.
5. The Malay population is more nearly self-supporting than has been supposed. The per capita consumption of rice by the non-Malay population is therefore higher than was thought. It is probable that the effect of the present slump will be a marked reduction in the imports of rice as it is likely that in times of prosperity the consumption is unnecessarily high. The present slump will probably result in an extension of the area cultivated.
6. The cultivation of padi by Malays is largely traditional; the commercial aspect is therefore to some extent of secondary importance to the Malay.
7. The cost of cultivation ranges from \$30—\$70 per acre. This divergence is accounted for by the facts stated in the previous paragraph and by the continuance of uneconomic methods of cultivation. A reasonable figure of cost of production by present methods is \$35 per acre.
8. Considerable divergencies as between the different States exist in relation to tenure of padi land. Where rules exist, steps can be taken to ensure the observance of prescribed dates of planting. This provision is essential to ensure control of pests and proper regulation of water supply.
9. Padi yields vary considerably, depending on the nature of the land cultivated, water supply and its control and methods of cultivation. Large areas of land exist in Malaya that are suitable for the cultivation of padi, and the best lands compare favourably with those which are to be found in any other part of the world.
10. Padi lands may be classified as—(a) continuous areas in the coastal alluvial plains, (b) small scattered areas in inland districts in the base of valleys or separated by ranges of hills and (c) situated on the banks

of large rivers. The first two are the most important, the third being less promising owing to liability to floods.

11. Improvements in water control are essential. These are divided into two classes, viz. large scale schemes in alluvial plains that can only be carried out by Government, and separate small schemes that can be undertaken by Government or the cultivators or a combination of the two. This latter alternative is recommended and has been operated in some instances.

12. In relation to the larger schemes, the need for drainage works is frequently quite as great as for irrigation. Many areas could be improved by this means while other areas could be rapidly developed by the adoption of such schemes.

    As a preliminary careful studies and surveys are necessary, the provision of which is at present lacking. These matters must be considered on a geographical and not a political basis.

    In reviewing the present constitution of the Hydraulic Branch it is pointed out that Malaya possesses no staff of Engineers which is exclusively concerned with irrigation; in the Straits Settlements the staff of the Public Works Department is inadequate to deal with irrigation questions, a reason for the abandonment in many instances of work on the problems of water control. In the Unfederated Malay States no provision exists with the exception of Kedah where an Irrigation Engineer is stationed. More extensive provision for irrigation works and for studies and surveys is essential.

13. It is considered that the possibilities of irrigating padi land by pumping where storage works are not feasible should be fully investigated.

14. Regarding the alleged shortage of water in the Krian irrigation scheme, there seems to be good reason to believe that the provision of large scale storage of water has led to wasteful methods of utilisation on the part of the cultivators, and that this wastage could be checked by the exercise of more rigid control in the distribution.

15. In relation to irrigation questions in different padi areas, the general principle is strongly advocated of forming standing committees comprising the administrative authority of the District, the Agricultural authority of the State and the Engineer in charge of Irrigation operations. The establishment of such sub-committees would result in the problem receiving more intelligent and closer attention from the officers chiefly concerned and would ensure co-operation and continuity.

16. To guard against past experience, the general line of policy in the future for the alienation of land for padi cultivation should be that land should not be alienated for cultivation under other crops, except after careful consideration.

17. The potential padi land in Malaya, not already alienated is probably 600,000 to 1,000,000 acres. The desirability for reconnaisance and

reporting on little known or practically unknown areas in respect of their suitability for padi cultivation is mentioned.

18. The Committee is not yet in a position to report on the most suitable means to be adopted for the development of potential padi areas.

19. In all probability the most suitable method of increasing production is by means of cultivating the land with modern machinery. Provided that efficient methods of water control are available, this method presents no insuperable difficulties.

20. The Department of Agriculture has, during the past ten years, carried out successful work in the direction of selecting and breeding improved strains of padi. These strains have become disseminated to a considerable extent in some districts. The system of trying out improved strains by means of test plots and by co-operative demonstration plots belonging to cultivators and also the scheme for the establishment of definite distribution centres for the sale of selected padi seed is approved by the Committee. It recommends that the system should be put into working order as early as possible and that any additions to staff which the scheme necessitates should be provided.

21. The establishment of efficient agricultural services in the Unfederated Malay States is essential if padi production and general agriculture is to be improved.

22. Padi producing areas may be classified under two heads: (a) areas which produce sufficient padi to meet the needs of the inhabitants and also to export the surplus production and (b) areas which only produce sufficient padi for the domestic needs of the cultivators themselves. In the latter case no economic problems respecting markets arise. In the former, questions of marketing are of considerable importance.

23. The maintenance of the Bagan Serai Government Rice Mill is considered essential in order that prices may be regulated on a fair basis.

24. Throughout the padi producing regions, debt amongst small cultivators is widespread, the percentage of indebtedness varying from about 40 to 90 in different areas. The system of advancing money to cultivators has been shown to be a failure.

25. The belief is expressed that in the widespread extension of co-operative principles lies the solution of this trouble, and steps should therefore be considered towards this end.

26. Consideration should be given to the possibility of imposing a small import cess on imported rice, the proceeds of which should be devoted to the improvement of irrigation and to experimental and other work having for its object the improvement of the industry generally.

Several other points have been considered by the Committee which it is hoped to discuss in the Final Report.

RICE CULTIVATION IN ITALY*

The area under rice cultivation in Italy is approximately 370,500 acres, a figure that is unlikely to increase. It is estimated that 90—95 per cent. of this land is situated in the North of Italy. All the padi is grown on irrigable land and there is an ample supply of water.

There are less than twenty varieties of rice grown in the country, the maturation period of these varies from 5 to 5½ months. The Rice Experiment Station at Vercelli imports varieties which are distributed after trials and acclimatization tests.

In the main rice-growing area, a seven year rotation of crops is practised viz: wheat, meadow land, meadow land with casual maize and transplanted padi followed by four years of padi cultivation.

Before ploughing, farm-yard manure is applied in varying quantities up to 16—17 tons per acre. The land is then ploughed and on some farms, when the tractor is used, the harrow is attached to the plough and both operations carried out at the same time. Tractors are employed on the large farms. On the smaller farms ploughing is done by means of horses and oxen. Where farm-yard manure has not been applied, artificial manure is applied at the time of sowing at the following approximate rate per acre,—superphosphate 710 lbs., potassic manure 265 lbs., and if the crop requires it 90 lbs. sulphate of ammonia after weeding.

The soil is then harrowed a second time and irrigation commences. After 4—5 days the soil is well mixed by means of a puddling machine drawn by a tractor or horses and then levelled by hand implements.

The seed for sowing is selected by an effective and popular machine.

It is estimated that 25 per cent. of the total rice area is transplanted. Transplanting machines have been tried but are not popular. The seed is sown by machine on large farms and broadcast on small farms. The type of sowing machine has been evolved after considerable experience, is efficient and very popular. The rate of sowing is 135 lbs. per acre. Thinning out is done by machine and hand. Weeding is effected with a horse-drawn machine where a drill has been employed, otherwise hand-weeding becomes necessary.

The water is drawn off about two to three weeks before harvesting commences and clover is sown (*Trifolium incarnatum.*) The padi is harvested with the sickle, machines not having been successful.

The crop is threshed by means of a threshing machine. The small farmer gets his crop threshed by means of an itinerating threshing machine. About 3,520 lbs. can be threshed in an hour. The grain is then winnowed and dried.

Only one crop of padi per year is grown. The yield per acre for the 1930 crop was estimated, on an average, at 2—3 tons equivalent to 100 to 120 bushels per acre.

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*Abstracted from an article by F. Burnett, M.C., M.A., (Oxon) *in The Agricultural Journal of British Guiana* Vol. III No. 3, Sept., 1930.

The proportion of rice to padi is 63—65 per cent. and the remainder is made up of 20 per cent. husks, 9 per cent. broken rice and 6 per cent. meal. The husks are used as firing material, the broken rice is generally converted into beer and there is also a market for the meal.

There are no co-operative buying or selling institutions in operation for this crop. Both the padi and the rice are sold to private stores which may be found in every large rice-producing district of the North of Italy.

EXPORT OF RUBBER FROM THE N.E.I. DURING SEPTEMBER AND OCTOBER, 1930. *

The export of plantation rubber was, as regards Java and Madura, considerably higher in September and October than in the same months of the previous year, viz. in September and October 1930, respectively 6,480 and 6,412 tons as against 5,154 and 5,180 tons in the same period of 1929. As in Java and Madura, the export of plantation rubber from the Outer Provinces was higher, viz. 8,424 tons in September, 1930 as against 7,605 tons in September, 1929. The export of native rubber at 7,030 tons however, remained considerably behind that of September, 1929 at 11,277 tons.

According to cables received from the Outer Provinces, it appears that the export of native rubber in October again shows a considerable fall for the principal ports.

Export of rubber in metric tons :—

	Djambi		Palembang		Bandjermasin		Pontianak	
	1929	1930	1929	1930	1929	1930	1929	1930
September	2377	1889	1566	695	2360	1368	1214	995
October	2064	1556	1457	608	2551	1065	1403	1007

* Translated from "Korte Berichten" of November 28th, 1930.

Reviews.

Reports of Technical and Divisional Officers of the Ceylon Department of Agriculture for 1929.

August, 1930, Ceylon Government Press, Colombo.

The Reports are to hand of the Technical and Agricultural Officers of the Ceylon Department of Agriculture for 1929, and as on the previous occasion are issued as two separate volumes.

The Technical Reports give an account of the various research activities of the Department; of these particular interest centres in the Report of the Economic Botanist which deals chiefly with breeding and selection work on padi. Mr. Lord stresses the influence of environmental factors on the yield of selected strains and points out that unless high yielding pedigree selections find conditions more or less similar to those under which the selections are made the results are disappointing. This does not altogether parallel experience in Malaya, but it seems likely that padi fields in Malaya are of naturally higher fertility than in Ceylon. It is also recorded that tests were made with varieties of padi from California but that none showed promise.

Some 415 selections were made during the year, while 372 previous selections were discarded. Manurial experiments were continued and indicated that under certain conditions phosphoric acid was a controlling factor. In relation to the application of green manure, it is concluded that on land which carries two crops of padi a year an application of green material is essential. On land carrying one crop the application of material other than that which naturally grows on the land may not be necessary except on sandy soils.

In the entomological section a lengthy account is given of the continuation of the work on termites. This work has already yielded useful results. In the agricultural section of the work a number of new host plants are recorded, while further progress is reported in relation to the bionomics of the pest.

In the Chemical Division report the principal line of investigation is concerned with green manures and their effects on soil conditions. Minor investigations, inter alia, have been concerned with soil erosion, soil fertility on Chena cultivation and nitrate removal in Peradeniya soils. It is, however, somewhat surprising to find that no work has apparently yet been undertaken on the systematic survey of the soil types occurring in Ceylon.

Mycological work has been apparently chiefly of a routine nature; an interesting addition to the reports of the Mycological and Entomological Divisions are the accounts given of the plant pest inspection work.

The Divisional agricultural reports are full of interest and comprise an account of much useful work accomplished. A record of a great deal of work done at the various experiment stations is given; a divisional centre has been established in the South Western District thereby bringing the scheme for the

establishment of agricultural centres a stage nearer completion.

The Farm Schools at Peradeniya and Jaffna continued operations while a new Farm School was opened in the Southern District towards the end of the year.

Cotton and tobacco purchase schemes continued to be operated successfully in the Southern and Northern Division respectively, while considerable activity was displayed in connection with village agricultural competitions and the like.

Rural co-operation, which is under the charge of the Department, apparently made satisfactory progress.

Occasion has previously been taken to comment on the soundness of the organisation for extensional work in Ceylon and the report appears to give further evidence of the correctness of this view.

H. A. T.

Durability of Malayan Timbers.

BY

F. W. Foxworthy, Forest Research Officer, F.M.S., and H. W. Woolley,

Formerly Assistant Forest Research Officer with

A Note on Termites

By H. M. Pendlebury, F.M.S. Museum.

Malayan Forest Records No. 8, 60 pp. 6 pls. Printers Ltd., Singapore, 1930.

Price $1.00 or 2s. 6d.

The differences of opinion on the durability of Malayan timbers led the authors to carry out—over a period of ten years—a series of simple and practical tests of the resistance of a large number of untreated Malayan timbers to insects and decay, and to compare such woods with well-known foreign woods subjected to similar tests. The results are stated in tabular form showing the woods destroyed in 2½ years or less and the performance of woods which were not destroyed in 5 years. Notes are also given of the detailed results of the 114 kinds of Malayan wood tested.

The conclusions are most important. The authors find that under the conditions of the tests fungus attack is of relatively minor importance, the wood usually being destroyed mainly by insects and that no wood tested was immune to the attacks of termites. Furthermore, hardness does not prevent insect attack, although pieces of wood containing sapwood were destroyed more quickly than those that were all heartwood. A list is given of thirteen timbers which

resisted attack for five years and may therefore be considered durable.

The second series of tests was concerned with the performance of timber surface treated with preservatives. Twenty-five preservatives were subjected to the test, three varieties of timber being used in each case. It will be realised that surface treatment cannot give anything like so long a period of protection as a thorough impregnation, in consequence of which the results of this work are somewhat inconclusive.

Sixteen preservatives gave perfect protection for one year, but their behaviour after the first year was various. With one exception all the satisfactory preservatives were of an oily nature. The authors conclude that there was nothing finally or decisively in favour of any one of the preservatives. Some obviously did better than others but it would be unsafe to say that any particular preservative was the best. Insects were responsible for most of the damage, but fungi were present in quite a number of cases. The preservatives used, at any rate in a surface treatment, do not prevent fungus attack.

Advice is given on the care of buildings—both permanent and temporary or semi-permanent structures—to prevent damages from termites.

Mr. H. M. Pendlebury writes an interesting account of the life-history of termites, some notes on the species most commonly met with in this country and a list of the 76 Malayan species.

Attention is particularly drawn to the futility of treating timber after construction work is completed as the termites obtain access by the untreated ends.

Planters and others who are from time to time faced with the problem of the erection of estate and other buildings and so have to decide on the material to be used in their construction will find this account of great interest, while its adequate index should render it a convenient book of reference.

D. H. G.

Miscellaneous.

ENTOMOLOGICAL NOTES.

Fourth Quarter, 1930.

Coconuts.

During this Quarter, the investigation of the control and economic importance of *Tirathaba rufivena* Walk., the greater coconut spike moth, has been completed. The series of experiments consisted of (1) allowing the spikes to burst naturally and of (2) removing the sheath enveloping the inflorescences when the spikes were considered to be on the point of bursting. The fall of female flowers from each inflorescence was recorded weekly during periods varying from 8—12 weeks.

The figures for the five parallel series are as follow :—

(i) Burst Naturally.

	Female Flowers at commencement of experiment.	*Tirathaba* bored.	Fall from causes other than *Tirathaba*.	Flowers (Nuts) remaining.
Series I. ...	330	79	130	121
Series II. ...	1381	132	556	693
Series III. ...	501	60	329	112
Series IV. ...	524	66	323	135
Series V. ...	2090	117	1013	960
Total ...	4826	454	2351	2021

(ii) Opened Artificially.

	Female Flowers at commencement of experiment.	*Tirathaba* bored.	Fall from causes other than *Tirathaba*.	Flowers (Nuts) remaining.
Series I. ...	501	7	306	188
Series II. ...	1161	39	510	612
Series III. ...	574	6	446	122
Series IV. ...	481	16	303	162
Series V. ...	2118	7	1141	970
Total ...	4835	75	2706	2054

Considered on a percentage basis, these figures give the following result :—

	Tirathaba bored. per cent.	Fall from causes other than *Tirathaba*. per cent.	Flowers (Nuts) remaining. per cent.
Burst Naturally ...	9.41	48.72	41.87
Opened Artificially ...	1.55	55.97	42.48

This result shows a reduction of 7.86 per cent. in *Tirathaba* bored female flowers by the removal of the sheath just before the spike would have burst, but at the same time an increase fall of 7.25 per cent. from causes other than *Tirathaba* occurs whilst an increase of only 0.61 per cent. takes place in the nuts remaining.

The figures demonstrate that the number of nuts bored by *Tirathaba rufivena* Walk. is considerably reduced by the removal of the sheath but indicate that this reduction increases the fall from causes other than *Tirathaba* rather than augmenting the number of flowers remaining.

These experiments were carried out on two estates planted with dwarf coconuts and for these areas the figures undoubtedly suggest that this moth is of no importance in reducing the yield of coconuts.

The colossal fall of female flowers from causes other than *Tirathaba* on these experimental areas is so high that the question may well be asked: would approximately 57 per cent. of the female flowers have to be bored by *Tirathaba* caterpillars before any loss in the yield of coconuts through the agency of this insect takes place?

A paper giving the details of these series of experiments is in course of preparation and will be published in the near future.

In a recent paper* "An Historical Note on *Tirathaba rufivena* Walk. (The Greater Coconut Spike Moth) and its Three Parasites in Malaya," the writer missed the first reference in India. Mr. Bainbrigge Fletcher, Imperial Entomologist, informs me that the first reference was contained in his Report for 1917—1918 (Sci. Repts. Agric. Res. Ins., Pusa, 1917—18 p. 98) and runs as follows:—

"A caterpillar found boring into young coconut fruits in the bunch on the tree and causing the young fruits to drop off. An accumulation of frass webbed up with silk indicates the presence of the borer. This insect is apparently an undescribed species of *Tirathaba* (Pyralidae)." With that reference, the larva, pupa and moth are figured.

Nipah.

The first occurrence of an Anthomyiid fly, No. 7327 (v. Plate at end) preventing the development of the female inflorescence of the nipah palm was recorded. The fly lays its eggs generally in groups on the male flowers as soon as they appear and sometimes on the sheathing leaves as soon as they separate. The maggots on hatching feed upon the soft juicy male flowers and later, mining the male flower stalks, reach the peduncle of the female inflorescence. Where the damage is serious the entire development of the female inflorescence is arrested and with the peduncle ceasing to function the production of juice is inhibited.

Experiments for the control of this fly were conducted and the results of two, namely (1) covering the inflorescence with mosquito netting and (2) removing the male flowers before they appeared, gave very satisfactory results. By

* Corbett, G. H., Scientific Series, No. 3, 1930, Department of Agriculture, Straits Settlements and Federated Malay States.

the removal of the male flowers, although eggs were found laid on some of the enveloping leaves, no attacked male flower stems were recorded and therefore no female stalks, as this fly causes no direct injury to the female inflorescence. In so far that more juice is considered to be obtained from artificially pollinated female flowers than from naturally pollinated, the control of this insect by removing the male flowers is undoubtedly economically justified. The control of this insect is assured and the details for incorporating the method for its control in estate practice only require to be settled.

Oil Palm.

The caterpillar damaging the fruits of the oil palm to which reference was made in "Entomological Notes for the Third Quarter" has been identified as the larva of a species of *Tirathaba.* No further reports of its injury have been received during this quarter.

Padi.

The investigation on the control of the padi borer, *Diatraea auricilia* Dudg., by the egg parasite—*Trichogramma nanum* Zehnt.—has been continued. This parasite is propagated on the eggs of the grain moth, *Sitotroga cerealella* Oliv., in Kuala Lumpur and field observations over an area of 33 acres of padi are made at Parit Buntar. During the month of December, 500,000 parasitised eggs per diem were sent and distributed throughout the experimental area.

Leptocorisa acuta Thunb., "Pianggang," occurred in large numbers on an area of padi in Perak as soon as the flowering stage was reached. Catching by means of sticks, one end of which was immersed in a sticky solution consisting of castor oil and rosin, was recommended.

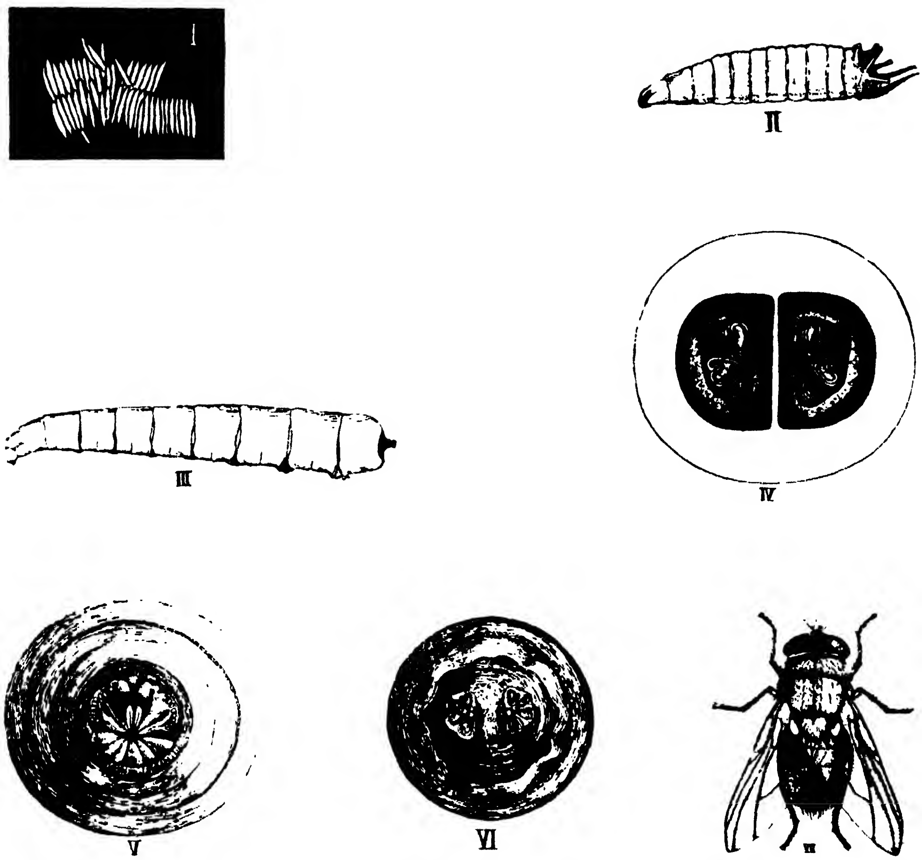
Tobacco.

Tobacco is not extensively grown in Malaya but enquires concerning *Gelechia heliopa* Low. from Malacca and *Psara submarginalis* Swinh. from Province Wellesley have been received.

The caterpillars of *G. heliopa* first mine the leaves and later the mid-ribs through which they reach the stem. Swellings are formed on the stem and, although pupation sometimes occurs in the mid-rib, it generally takes place within the galls. This insect can be a very serious pest to seedling tobacco. In the Dutch East Indies, nurseries are protected by covering them with mosquito netting early in the evening as the moths are not found on the wing during the day time.

The caterpillars of *Psara submarginalis* Swinh. are more frequently reported damaging the leaves of tobacco in Malaya. The plants may be protected by a 1 per cent. lead arsenate spray.

ANTHOMYIID FLY—A PEST OF INFLORESCENCE OF NIPAH.



Description of Plate.

I. Eggs (nat. size 1 mm.). II. Newly hatched maggot (nat. size 1 mm.). III. Full-grown maggot (nat. size 15 mm.). IV. Post. end of maggot. V. Ant. end of puparium. VI. Post. end of puparium. VII. Fly (nat. size, about 7 mm. long). Figs. (1), (2), (3), (4), (5), and (6) after Mr K. Anthony, Fig. (7) after Che M. Razaly.

K.P.CO.LTD.

Tea.

The aphid—*Toxoptera aurantii* Boyer.—caused some damage to the young shoots of tea and the cricket, *Brachytrypes achatinus* Stoll., was reported cutting young seedlings and dragging them into their burrows. Heavy watering will drive these crickets to the surface. Digging is sometimes practised.

Coffee.

The coffee berry beetle borer (*Cryphalus hampei* Ferr.) has been reported from previously unrecorded coffee areas. A circular in English, Chinese and Malay has been distributed.

Miscellaneous.

Locusts and Grasshoppers.

No further reports of the presence of the locust—*Locusts migratoria*—have been received from the Tampin or any other area in Malaya.

Patanga succincta L.—the " Bombay " Locust—has been reported from Trengganu damaging hill padi. Individual specimens of this locust from time to time have been collected in Kuala Lumpur and other places in Malaya. The last reference is of an individual from Cameron's Highlands. It is interesting to note that in the consignment of specimens adults as well as last instar nymphs were received.

Since prominence was given to the presence of *L. migratoria* in Malaya several species of grasshoppers have been forwarded. *Valanga nigricornis* Burm. —a large greenish grasshopper—has been forwarded on several occasions whilst *Catantops humilis* Serv. and *Catantops splendens* Thunbg. were abundant in Pahang where they damaged budded rubber.

"White Ants"

An unusual case of " white ants " causing damage to golf greens by covering the grass with a fairly hard, thin, even, compact layer of earth was reported. Wherever these ants had been noticed, patchy areas of unhealthy looking grass resulted. Spraying with a good quality of lead arsenate was recommended.

The degree of immunity of various woods to " white ant " attack has often been under consideration. The writer of these notes buried a piece of " chengal " or " chengai " (*Balanocarapus Heimii*) on the 12th. March, 1926, in a " white ant " nest. This piece of wood was unearthed and examined on various dates and on each occasion placed in different " white ant " nests. The last examination was made on the 29th. November, 1930, and on each occasion no injury was observed, although the wood was completely covered with " white ant " runs. It would appear that " chengai " is immune to " white ant " attack. " Cellactite," a

roofing material, was buried on the 22nd. December, 1924, in a "white ant" nest and has withstood "white ant" attack up to the time of writing.

Ants in Bungalows.

Enquiries have been received concerning control measures for ants in houses. A mixture which is widely used in America has been found very satisfactory in Malaya for ridding bungalows and houses of several species of ants. The composition of the mixture is as follows:—

Water 11 pints; tartaric acid (crystallised) 7 grams; benzoate of soda 9 grams; granulated sugar 12 lbs.; honey (strained) 2 lbs.; sodium arsenite (chemically pure) $\frac{3}{4}$ oz.

This makes about $2\frac{1}{2}$ gallons of syrup. Probably about one pint will be found sufficient to free a bungalow from ants. The mixture is prepared as follows:—

Warm ten pints of water and when tepid add tartaric acid, then benzoate and then the sugar slowly while stiring to prevent burning. Slowly bring to boil and allow to simmer for about 35 minutes. Remove from the fire and add water to allow for evaporation. Stir in the honey before the mixture cools. Then add the sodium arsenite which has been dissolved in one pint of hot water and partially cooled.

This mixture is placed in shallow vessels about the houses or sponges which have been immersed in the solution are placed in tins with punctured lids.

G. H. C.

Departmental.

DEPARTMENTAL DISPLAYS AT AGRICULTURAL SHOWS.

At the Field Officers' Conference in 1929 the question of Departmental displays at Agricultural Shows was discussed. It was pointed out that these shows form an admirable means for disseminating information among the rural population, particularly among Malays. It was further pointed out that in order to make the work effective it was necessary that a definite plan of operation should be envisaged, and in consequence, it was decided that departmental displays should be divided into three classes, viz.—

(a) Comprehensive displays to be staged at the main agricultural exhibition held in Kuala Lumpur;

(b) Smaller, but nevertheless fully comprehensive, displays to be staged at important regional shows covering more than one district, such as the Taiping Show in the northern part of the Federated Malay States and the Seremban Show in the southern part of the Federated Malay States.

(c) Smaller displays designed to illustrate particularly points for staging at District Shows.

It was further agreed that a comprehensive programme of exhibits should be drawn up and that for the smaller shows a standardised type of exhibit should be utilised in all cases. Moreover, as the information which it was desired to disseminate included all crops, and also, to an extent, agricultural co-operation, it was decided that the exhibits as far as possible should be in the nature of combined displays in which the Department of Agriculture, the Rubber Research Institute and, as circumstances permitted, the Co-operative Department should participate. This programme has been closely followed during the past season.

In all, seven Agri-Horticultural Shows were held, namely :—The Seventh Malayan Exhibition at Kuala Lumpur on the 19th—21st April; the Kedah Agricultural Show at Alor Star on the 10th and 11th July; the Negri Sembilan Agri-Horticultural Show at Seremban on the 25th and 26th July; the Malacca Agri-Horticutural Show at Malacca on the 26th July; the North Perak Agri-Horticultural Show at Taiping on the 24th August; the Pekan-Kuantan Show at Kuantan on the 26th August, and the Temerloh Agricultural Show at Temerloh on the 27th September.

Exhibits were staged at each of these Shows in accordance with the programme outlined above, and in the following paragraphs a brief account is given of details in connection with each.

It may be added that the policy adopted has proved markedly successful. It has been found possible to stage comprehensive exhibits illustrating a number of points and the result has been seen in the keen interest which has been shown in the exhibits by large numbers of persons attending the shows.

At all the above-mentioned Shows the Department of Agriculture displayed

exhibits of certain agricultural products of the country, together with their pests and diseases. European and other officers of the staff of the Department were in attendance at all the Shows and gave demonstrations and explained the exhibits.

The Malayan Exhibition.

At this exhibition, a large display was staged comprising oil palm and its products, tea, sisal hemp, tuba, yams and sugar palm products from the Government Experimental Plantation, Serdang. The work of the Department in relation to padi work was demonstrated by a collection in ear form, and also as clean rice of high yielding strains of padi which have been isolated and multiplied. Special features of the coconuts and copra exhibits shewed the common defects of copra caused by using under-ripe and over-ripe nuts, storage under wet conditions, insect attack and burning during drying.

The mechanical compositions of eight typical soils found in Malaya were shewn in long glass tubes with the percentages of the various constitutents on cards. These were connected by means of streamers with a geological map shewing where the soils occur in Malaya.

Some of the more important insect pests of padi and of coconuts were staged by means of live and preserved specimens. Demonstrations were given daily of the breeding of parasites for the control of padi stem borers.

The rat pest was demonstrated by various exhibits shewing the damage occasioned by this pest and methods recommended for efficient control.

Diseases of oil palms, coconuts and tea were staged including stem rot of oil palms and fructifications of species of fungi which are possible causes of the diseases.

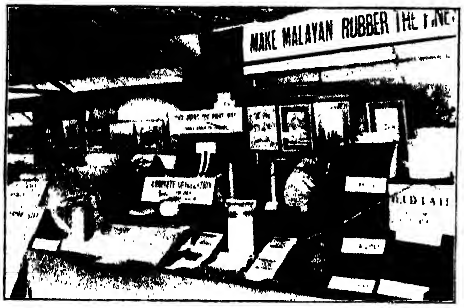
The Department exhibited a Large Black boar and sow and a Middle White boar and sow with two young Middle White pigs in the Pig Show.

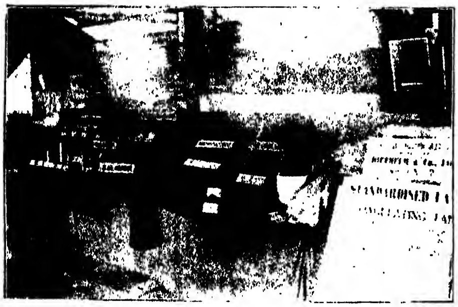
In addition to the daily demonstrations given to the general public, special demonstrations were given by officers of the Department of Agriculture and the Rubber Research Institute to a large number of delegates and local headmen from different parts of Malaya who were attending a Conference of Rural Co-operative Credit Societies.

Explanatary cards in English and Malay, various leaflets in the vernacular and suitable maps and diagrams enabled visitors to appreciate the lessons to be learned from the exhibits of both Departments. The same system was adopted in displaying exhibits at all the Shows during the year. Publications of the Department in English, Malay and Chinese were also displayed for sale at this Exhibition and at all District Shows.

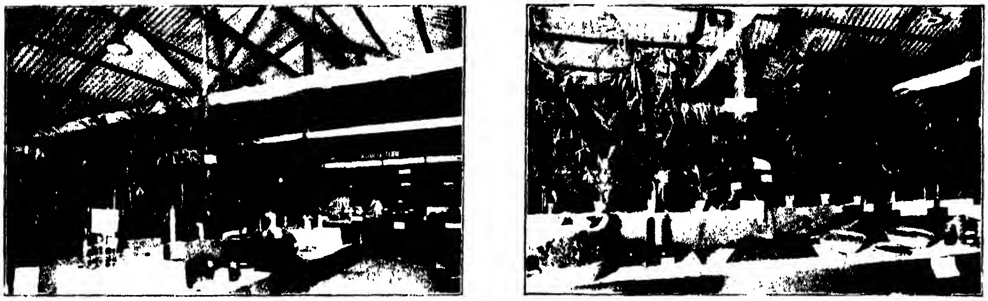
The Rubber Research Institute of Malaya staged a comprehensive series of exhibits in connection with rubber. These included all the important pests and diseases with methods of treatment. Budding operations, of which several demonstrations were given daily on the most satisfactory method of procedure in these operations, proved highly popular especially owing to the fact that many

THE MALAYAN EXHIBITION, 1930.

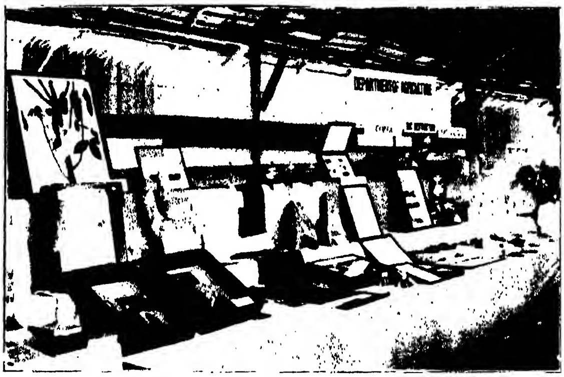




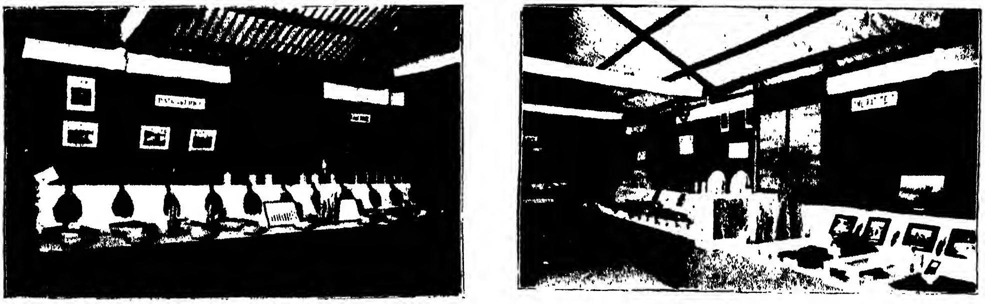
DEMONSTRATION EXHIBITS STAGED BY THE RUBBER RESEARCH INSTITUTE OF MALAYA.



The Malayan Exhibition, 1930.
Oil Palm Exhibits staged by the Department of Agriculture.



Exhibits staged by the Department of Agriculture.
at the Malacca Exhibition, 1930.



The Malayan Exhibition, 1930.
The Cereals and Rat Pest Exhibits of The Department of Agriculture.

were given entirely in Malay.

Factory methods adopted to produce a first class product were contrasted with methods producing an unsatisfactory product. All the phases of preparation of raw rubber from latex to the finished raw product in the form of sheet, crepe, sole crepe, preserved and concentrated latex were shewn, together with the various chemicals used in the preparation of rubber.

District Shows.

At the Kedah Agricultural Show the Departmental display occupied a space of 20 feet by 3 feet. The exhibits were arranged in sections, viz. strains of padi, rat destruction methods, copra and coconuts, tapioca and gaplek, pests of padi and coconuts and coconut diseases.

At this and other district shows, the Rubber Research Institute staged displays somewhat similar to the Kuala Lumpur exhibit but on a smaller scale. Exhibits were mainly concerned with the treatment of diseases of the rubber tree, the improvement of yield of latex by budding and the production and preparaton of raw rubber.

Seremban and Taiping Shows. At the Negri Sembilan and Perak North Agricultural Shows held at the above centres the Department displayed exhibits illustrating oil palm cultivation, palm oils and their uses and high yielding strains of padi; faults in copra production with instructions for the improvement of the product; pests and diseases of padi, the coconut and oil palm; tea; and rat destruction by means of traps and poisoned baits. In Seremban an exhibit of soils was included similar to that displayed in Kuala Lumpur. This exhibit was omitted from the Taiping Show, but the rat destruction exhibits was more comprehensive at this centre, the making of poisoned bait being demonstrated.

The Rubber Research Institute staged exhibits similar to those at Kuala Lumpur, but on a smaller scale. At the Taiping Show an exhibit was provided consisting of representative soil profiles shewing jungle soil with its distinct humus layer, good estate soil with the humus layer still present, and bad, improperly managed estate soil with the humus layer absent. Samples of artificial manures as used on rubber estates were also exhibited.

Malacca, Kuantan and Temerloh Shows. At agricultural shows held at these centres the departmental exhibits were similar to, but on a smaller scale than, those put up at other shows. The Institute also displayed small exhibits embodying chiefly the scheduled diseases of rubber with identification and treatment, also the proper treatment of latex for the production of good rubber. Demonstrations of rubber budding were given at the Temerloh Show and proved of great interest.

At these smaller shows a particular attempt was made to interest the smallholder and in this both departments succeeded to a large degree.

FROM THE DISTRICTS.

The Weather.

There was a steady and well distributed rainfall throughout the month. This was sufficient in parts of Pahang to cause a minor flood at Pekan, but elsewhere there were only a few unimportant and local instances of damage to padi or other crops caused by deep water.

Remark on Crops.

Rubber.—There was a further slight improvement in the local prices given for rubber from small holdings, smoked sheet selling for $14.20 and unsmoked sheet for $9.15 per picul.

Mouldy Rot disease continued to be prevalent and its control required persistent attention from the inspecting officers.

Padi.—Prospects for this season's harvest continued to be satisfactory on the whole. Unfortunately, while fair to good yields are expected, the price of padi has fallen to the disadvantage of the large areas, such as those in Kedah and Krian, where the surplus padi for sale is produced.

Harvesting was commenced in parts of Kuala Kangsar and Batang Padang Districts of Perak and in Jelebu District of Negri Sembilan during the month. It was continued in many parts of Selangor and Pahang.

In Krian a number of additional areas damaged by *Sogata furcifera* (*pallescens*) were found. Although the insect was widely distributed in the District, no large areas were damaged very severely, since the pest decreased in numbers soon after its presence had been rendered noticeable by the characteristic yellowing of the padi leaves. This insect disappeared from previously attacked areas in Kuala Kangsar District, but was reported from certain areas in Province Wellesley Central and the Dindings where the water had become stagnant.

Fruit.—In Province Wellesley good crops of durian, mangosteen, rambutan and machang were harvested during the month. A large crop of durians was harvested in Bukit Gantang Mukim of Larut District, while a fair crop of fruit of various kinds was obtained in Perak South. In Selangor the prospects for the fruit crop were reported to be poor, probably owing to heavy rains during the flowering period. In Klang and Kuala Langat Districts limited supplies of chiku, rambutan, pulasan, durian and jambu were available. In Pahang East also the fruit crop was maturing.

Pineapples.—In Singapore large supplies of fruit were available, but prices remained too low to allow for any reasonable profit to the grower.

Vegetables.—In Selangor there was a general decrease in both wholesale and retail prices for vegetables. This was believed to be due to some extent to large importations from China, which, owing to present exchange conditions, can be disposed of for prices below those of the local produce.

Notes on Demonstration Stations and Padi Test Plots.

Telok Chengai Padi Experiment Station, Kedah.—The growth of the padi was satisfactory. Attention was devoted to water control, weeding and the cutting out of plants not true to type. Local padi planters are evincing much interest in the work in progress.

Kuang Padi Test Plot, Selangor.—Considering the difficulties that have been experienced, especially with regard to damage by stem borers, the crop appeared satisfactory.

The Nachin variety which matured a month earlier than any of the other strains was completely destroyed by sparrows, so that no crop could be obtained.

Harvesting of the other strains commenced in the last week of the month. Owing to uneven ripening, reaping will be protracted.

Kuala Lipis Demonstration Station, Pahang.—One plot of groundnuts was planted. The tapioca trial plots were harvested and the varieties were classified for yield, ease of lifting and cooking qualities. The three best varieties were replanted to provide material for distribution.

Pekan Demonstration Station, Pahang.—Vegetable crops were lifted and the land was left fallow during the monsoon season. Some 100 marcots of eight different fruit trees were prepared.

Pineapple Demonstration Station, Singapore.—Clearing was completed and the pineapple and rubber plants were stacked, since burning was rendered impossible by the prevailing wet weather. Cultivation and fencing were commenced. Tenders were let and sites marked out for the buildings.

Plants Distributed.

Plants distributed from the Seremban Station included seedlings of six kinds of fruit trees, cuttings of tapioca and carpet grass and seeds of sweet corn and annatto. From the Kuala Lipis Station Brazil nut seedlings were distributed to eight school gardens in Temerloh District.

Rat Destruction.

In Province Wellesley payments were made for 220,021 rat tails, making the total collected during the year 1,514,928. In Krian rewards were paid for 34,055 tails during December and the total number of tails paid for and destroyed during 1930 was 1,791, 790.

In spite of the very large number of rats destroyed a little damage to padi has been reported both in the Province and in Krian in fields adjoining patches of jungle or uncleared land, or the banks of irrigation canals, all of which afford cover for rats.

In practically all the States and Settlements the varying measures taken to arouse interest in the control of rats in padi fields have yielded useful results.

DEPARTMENTAL NOTES.

The Director of Agriculture, S.S. and F.M.S. was on duty in Singapore from 18th. to 21st. December, 1930.

Agriculture in Kelantan.

Mr. J. A. Craig, Agricultural Field Officer, Perak South, has been seconded for service in the State of Kelantan from December 8th. 1930.

Mr. Craig will make an intensive study of local conditions of cultivation and of local padi strains and in conjunction with the Administrative Officers, will collect statistical data regarding agriculture in that State. At the same time he will carry out, with the aid of the technical branches of the Department of Agriculture, S.S. & F.M.S. a detailed investigation of soil conditions throughout the rice-growing areas.

Kelantan contains a large Malay population and extensive areas of cultivated padi land. Crops, however, have of late years been insufficient to satisfy local requirements. The padi problem will therefore occupy first place in the programme of agricultural investigation in the State, although attention will also be given to subsidiary agricultural problems.

Transfer of Mr. Curtler.

Mr. E. A. Curtler, Assistant Agriculturist has been transferred to Perak South, as Acting Agricultural Field Officer. His head-quarters are at Tapah.

Vernacular Publications.

With the December issue, which has just been published, the Malay journal of the Department, *Warta Perusaha'an Tanah,* completes its eighth year of publication. The circulation of this journal has steadily increased throughout Malay speaking countries. The amount of correspondence received from Malay agriculturists is evidence that the journal is widely read and appreciated.

The Chinese Agricultural Journal completes its fourth volume with the present number. Its circulation now nearly equals that of the Malay publication.

The Department is investigating the advisability of commencing a periodical in the Tamil language. One difficulty in this connection is to estimate probable circulation. The Director welcomes suggestions on this contemplated publication.

Government School of Agriculture, Malaya.

The buildings of the Government School of Agriculture at Serdang, near Kuala Lumpur are now practically completed. It will be remembered that the Foundation Stone was laid by H. H. The Sultan of Selangor on March 19th. 1930. The School will be opened in May, 1931.

The Prospectus of the School has been published and copies may be obtained on application to the Director of Agriculture, S.S. & F.M.S., Kuala Lumpur.

Statistical.

MARKET PRICES.

December, 1930.

Rubber.—The average price in Singapore was 14.3 cents per lb. against 14.2 cents in November. The average London price was 4.3d. compared with 4.4d. for the previous month. Prices for December have shewn a downard tendency.

Palm Oil.—London price on 23rd December was £16.12.6 per ton, F.O.B. on a basis of 18 per cent. F.F.A. The market seems to be losing its firmness and sellers are much more prominent.

Copra.—Singapore average prices for December: Sundried, $6/-; Mixed, $5.66; Cake, $1.75 per picul. Corresponding prices in November: $6.32½; $6.00; $1.75. Decline in prices has been steady following the easier tendency in consuming centres.

Gambier.—Supplies are small and demand is negligible. Average prices in December were; Block, $9.37; Cube, No. 1, $14.62 per picul against $9.08 and $14.25 respectively in November.

Cloves.—Zanzibar quoted at $62 nom. Amboina $63 to $64 per picul.

Nutmegs.—Market rather firmer following a good demand from the Continent. Singapore average prices: 110's, $25.37; 80's, $31.25 per picul compared with $26.87½ and $31.12½ in November.

Mace.—Average Singapore prices: Siouw, $73.50; Amboina, $50.00 per picul. The corresponding averages for November were $83.12½ and $60.

Pepper.—Singapore, black, $22.62½; white $39.00; Muntok, white, $40.50 per picul. Corresponding average prices for November were $23.75; $39.50; $41.37½. Market has been steady, but the demand is poor.

Sago.—First half of December, prices were steady to firm on improved demand from Europe. Later there was heavy arrival with limited demand resulting in a rapid price decline. Average Singapore prices for December: Pearl, small fair, $6.50; Flour, Sarawak fair, $3.04, these averages being identical with those of the previous month.

Tapioca.—Market has been steady but quiet. Average prices for December: Flake, fair, $4.65; Pearl, seed, $5.71; Pearl, medium, $6.50 per picul compared with $4.47½; $5.81; $6.50 per picul in November.

Pineapples.—Demand has been poor but prices for most grades are unchanged. Singapore average prices for December were: 1½ lb. cubes, $3.36 per case against $3.28 in November; 1½ lb. sliced, flat, $3.20 per case compared with $3.18¾ in the previous month; 1½ lb. sliced, tall, $3.47½ against $3.65 per case in November.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Market Reports published in December, 1930. Palm Oil reports are kindly supplied by Messrs. Lewis and Peat (Singapore), Ltd.

1 picul = 133⅓ lbs.

The dollar is fixed at two shillings and four pence.

MALAYA RUBBER STATISTICS

STOCKS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORTS AND EXPORTS, AND THE ESTIMATED PRODUCTION OF ESTATES OF LESS THAN 100 ACRES, FOR THE MONTH OF NOVEMBER, 1930, IN DRY TONS.

Territory	Stocks at beginning of month			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated)		Imports				Exports (including re-exports)				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1930	during the month	during the year 1930	during the month: Foreign	during the month: From Malay States	during the year 1930: Foreign	during the year 1930: From Malay States	during the month: Foreign	during the month: Local	during the year 1930: Foreign	during the year 1930: Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	10,036	15,247	13,013	127344	8,283	101338	Nil	7	Nil	66	13,391	5,905	167314	60,858	11,526	15,764	...
Johore	...	2,196	4,807	3,699	38,992	3,733	42,948	Nil	4	Nil	23	1,231	6,337	11,865	71,182	2,264	4,607	...
Kedah	...	464	2,312	2,306	21,742	1,225	13,233	Nil	Nil	30	Nil	1,029	2,401	8,589	26,259	511	2,366	...
Perlis	...	10	9	7	88	17	146	Nil	Nil	Nil	Nil	Nil	22	Nil	245	15	6	...
Kelantan ...	...	163	168	337	2,848	187	3,997	1	Nil	34	Nil	102	469	844	6,108	152	133	...
Trengganu* ...	..	55	50	105	1,253	52	625	Nil	Nil	Nil	Nil	Nil	157	Nil	1,879	55	50	...
STRAITS SETTLEMENTS																		
Malacca ...	...	2,516	1,907	1,378	13,388			Nil	2,962	Nil	21,797	4,605		45,196		3,166	1,908	...
Province Wellesley	...	117	686	528	5,124											145	744	...
Dindings ...	...	96	117	100	1,075	† 1,417	32634									140	112	...
Penang	1,258	4,136	13	11	113			498	3,400	7,754	36,596	3,986	Nil	60,126	Nil	4,364	17	671
Singapore ...	3,476	27,614	347	189	2,467			5,942	8,918	93,144	108049	15,046		217409		29,056	321	3,345

ANALYSIS OF COLONY, FEDERATED MALAY STATES AND JOHORE DEALERS' STOCKS AT END OF MONTH, IN DRY TONS.

Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley, Dindings and Malacca	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	8.566	16,560	2,657	2,346	990	31,119
Crepe	529	9,722	957	695	265	12,168
Unsmoked sheet ...	1,319	2,774	750	410	591	7.374
Scrap and lump ...	1,112				418	
Total all Grades ...	11,526	29,056	4,364	3,451	2,264	50.661

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less then 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, *i. e.* Column [7] = Columns [13] + [14] + [17] + [18] + [19] — [2] — [3] — [4] — [5] — [9] — [10]

3. Colony Dealers' Stocks are as published in Return I. & E 6, dated 10 December, [S.S. *Gazette* Not. No. 2546], being dry weight as estimated by Dealers themselves.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked Sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I & E. 5, dated December 3, [S.S. *Gazette* Not. No. 2491], foreign wet imports being reduced to dry weight by 25%.

6. Foreign Exports of each State and Settlement are those published in the Malaya Monthly Trade Return [Appendix II] and are distinct from Ocean-Shipments as published in Return I & E. 4, dated December 2, *Gazette* Not. No. 2490 [Appendix IV to Monthly Trade Return].

*7. Stocks and production in Trengganu are estimated from figures supplied by the Commisioner of Lands.

8. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore is always the most reliable.

†9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the columns comprising it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

Singapore December 19, 1930.

J. I. MILLER, M.C.S.
Acting Registrar-General of Statistics, S.S. and F.M.S.

SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES, STRAITS SETTLEMENTS AND KEDAH FOR THE MONTH OF NOVEMBER, 1930.

State	District	Acreage of padi land	Acreage planted	Percentage 4 - 3	Gross crop	Crop per acre 6 - 4	Remarks
		Acres	Acres		Gantangs		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Perak	Perak North :						
	Krian	53,250	...	...	...	...	About 47,050 acres planted.
	Larut	8,525	...	...	...	...	Planting almost completed.
	Selama	3,450	...	...	...	...	Do. do.
	Kuala Kangsar	13,997	13,797	...	...	...	Planting completed.
	Upper Perak	3,739	3,739	...	...	...	Do.
	Perak South :						
	8 Mukims	14,817	...	...	...	...	Cultivation and transplanting in progress over about 13,000 acres—rest one to three months planted.
		97,778	...	...	...	...	
Selangor	Ulu Langat	2,670	2,214	...	...	...	Harvesting commenced in Ulu Langat. Rest flowering.
	Kuala Lumpur	797	677	...	.	...	Harvesting commenced in K. Lumpur. Rest flowering.
	Ulu Selangor	1,205	1,013	...	...	...	Flowering.
	Kuala Selangor	18,564	...	...	...	...	Harvesting commenced in Jeram. Rest of the area is being transplanted excepting Sekenchau and Tanjong Karong—694 acres—which have been abandoned.
		23,236	...	...	...	...	
Negri Sembilan	Seremban	4,904	...	...	...	...	Flowering started excepting in Pantai, Lenggeng and Ulu Beranang—2,356 acres.
	Kuala Pilah	17,931	...	...	...	...	About 5,000 acres tillering well-rest not yet flowering.
	Port Dickson	159	152	...	...	...	Not yet flowering.
	Jelebu	3,116	...	...	...	...	Flowering and fruiting—not yet ripe.
	Tampin	2,609	...	...	...	...	Gemas flowering but the others are not yet.
	Rembau	7,897	...	...	...	...	Flowering.
		36,616	...	...	...	...	

SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES, STRAITS SETTLEMENTS AND KEDAH FOR THE MONTH OF NOVEMBER, 1930.—(*Continued.*)

State	District	Acreage of padi land	Acreage planted	Percentage 4 - 3	Gross crop	Crop per acre 6 - 4	Remarks
		Acres	Acres		Gantangs		
(1)	(2)	(3)	(4)		(6)	(7)	(8)
Pahang	Pahang West :						
	Temerloh	13,061	8,969	...	...	...	Harvest in progress. Area of plantable land revised.
	Raub	5,112	...	...	...	...	Harvesting commenced.
	Kuala Lipis	8,450	...	...	...	...	River mukims—6,750 acres—harvest in progress—rest up to 4 months planted.
	Bentong	1,126	872	...	...	...	Harvest commenced. Area of plantable land revised.
		27,749			...	...	
Straits Settlements	Malacca :						
	Central	15,723	14,931	...	...	...	Flowering commenced. Area of plantable land revised.
	Alor Gajah	11,136	10,337				do. do. do.
	Jasin	5,756	3,678	...	...	...	Transplanting almost completed.
		32,615	28,946	...	...	...	
	P. Wellesley :						
	North	18,560	...	...	...	...	Planted 2 months.
	Central	10,539	...	...	...	...	Do. 1 month excepting over about 1,500 acres.
	South	4,649	...	...	...	...	Planting not yet completed.
		33,748	...	...	...	...	
	Penang	4,000	...	...	...	...	Planting practically completed.
	Singapore	Nil	...	...	...	...	
Kedah	K. Star	105,060	...	...	...	...	Planting almost completed.
	Langkawi	4,908	...	...	...	...	
	P. Terap	6,637	...	...	...	...	
	Kubang Pasu	35,094	...	...	...	...	
	K. Muda	13,267	...	...	...	...	
	Baling & Sik	19,156	...	...	...	...	
	Kulim	3,642	...	...	...	...	
	Bandar Bahru	2,528	...	...	...	...	
	Yen	19,748	...	...	...	...	
		210,040	...	...	...	...	

J. GORDON-CARRIE,
Statistician.

N.B. The figures given in the latest return under Column 3 may be accepted as more accurate than any given in previous returns.

METEOROLOGICAL SUMMARY, MALAYA. NOVEMBER, 1930

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day Amt.	Number of days: Precipitation*	Precipitation, 1mm. or more	Thunder-storm	Thunder heard	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent	Length of Day
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.							hr.	hr.	%	hr.
Railway Hill, Kuala Lumpur, Selangor ...	90.5	71.9	81.2	95	70	81	74	83.3	83.8	7.05	179.1	1.58	18	14	3	8	10		155.50	5.18	43	12.0
Bukit Jeram, Selangor ...	88.2	73.0	80.6	91	70	82	76	84.7	86.5	9.16	232.7	1.40	21	16	...	9	2		195.65	6.52	54	12.0
Sitiawan, Perak ...	88.4	73.0	80.7	91	71	84	75	84.1	84.6	5.32	135.1	1.90	21	17	9	16	1		175.00	5.83	...	...
Kroh, Perak ...	83.7	70.5	77.1	90	68	75	72	79.3	81.9	6.17	156.7	1.74	25	22	...	2	9		117.65	3.92	...	...
Temerloh, Pahang ...	87.3	72.5	79.9	92	70	79	74	83.4	85.1	8.36	212.3	4.30	19	15	2	20	7		142.45	4.75	39	12.0
Kuala Lipis, Pahang ...	87.2	71.4	79.3	91	69	78	73	82.5	83.7	9.88	250.9	1.90	20	18	14	16	24		137.00	4.57	...	...
Kuala Pahang, Pahang ...	85.1	73.8	79.5	90	71	77	76	82.6	85.3	18.53	470.7	6.11	21	18	5	10	1		167.00	5.57	46	12.0
Cameron's Highlands, Rhododendron Hill, Pahang ...	71.1	59.4	63.3	75	58	67	61	...	...	8.94	227.1	1.91	27	22	...	11	3		93.45	3.11	26	11.9
Cameron's Higlands, Tanah Rata ...	71.4	57.7	64.5	74	52	68	62	69.9	70.0	8.25	209.5	1.98	26	23	...	14	...		98.45	3.28	27	11.9
Fraser's Hill, Pahang ...	73.1	61.7	67.4	79	60	66	63	70.7	71.5	8.80	223.5	1.70	23	16	...	13	15		122.90	4.10	34	12.0
Mount Faber, Singapore ...	86.9	74.1	80.5	91	71	81	79	81.0	82.8	11.64	295.7	2.96	22	16	2	13	...		172.30	5.74	47	12.1
Butterworth, Province Wellesley ...	85.7	73.8	79.7	90	72	80	76	82.9	84.0	7.60	190.0	1.47	19	15	1	19	1		160.45	5.35	...	...
Bukit China, Malacca ...	84.7	73.5	79.1	88	71	81	76	82.5	83.9	6.66	169.2	1.23	18	15	...	5	...	1	174.60	5.82	48	12.0
Kluang, Johore ...	86.6	72.1	79.3	91	70	75	73	81.0	81.9	8.82	224.0	1.28	18	15	2	8	13		131.50	4.38	37	12.0
Bukit Lalang, Mersing, Johore	85.7	72.4	79.1	90	70	78	74	81.0	81.8	13.95	354.3	3.12	23	19	2	21	...		159.90	5.33	44	12.0
Alor Star, Kedah ...	86.3	73.6	79.9	91	72	77	75	84.8	85.8	4.92	125.0	0.69	20	15	...	5	2		141.25	4.71	...	...
Kota Bharu, Kelantan ...	84.0	73.3	78.7	90	71	74	75	82.6	84.1	37.61	955.3	5.18	25	23	...	5	...		113.45	3.78	...	...
Kuala Trengganu, Trengganu	84.2	72.7	78.5	90	70	73	75	80.5	81.9	42.17	1071.1	10.61	22	21	...	11	1		134.80	4.49	...	...

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

Malayan Agricultural Journal.

Vol. XIX. FEBRUARY, 1931. No. 2

COMMITTEES OF THE DEPARTMENT.

The Advisory Committee.

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The Director, Rubber Research Institute.
The Director of Co-operation.
The Principal, Sultan Idris Training College.
Yang Teramat Mulia Raja Abdul Aziz, C.M.G., Raja Muda of Perak.
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(Under Sec. 4 of Agricultural Pests Enactment 1913).
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Coconut & Oil Palm Research Committee.

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The Mycologist.
The Agriculturist.
The Economic Botanist.
The Plant Physiologist.
The Agricultural Economist.
The Agricultural Chemist.
The Entomologist.
The Chief Agricultural Field Officer.
The Assistant Chemist for Copra Investigations (Secretary).

CORRECTIONS TO BULLETIN No. 1, SCIENTIFIC SERIES. JUNE, 1930.

Page 7, line 1 from bottom, last word, for "spining" read "spinning."

Page 20, lines 5 and 8, for "Groot" read "Goot."

Page 20, line 7, for "*Nephopteryx*" read "*Nephotettix*."

THE

Malayan Agricultural Journal.

FEBRUARY, 1931.

EDITORIAL.

Voluntary Preference for Empire Products. For the past five years the Imperial Economic Committee has studied the possibilities of improving the marketing of Empire produce within the United Kingdom. The Committee early came to the conclusion that for success in any policy of voluntary preference it was essential that the consumer be able to distinguish Empire goods from foreign goods and that he be educated to appreciate the economic advantages of buying within the Empire. Further, it was necessary for the Empire producer to realise that his products must at least equal those of his foreign competitor in quality, quantity and continuity of supply.

The Empire Marketing Board has been responsible for the publicity aimed at the education and guidance of public opinion in favour of voluntary preference.

As a result of this effort, the doctrine of voluntary preference has quickened and interest in the Empire become more defined. The Progress Report for 1930 of the Imperial Economic Committee briefly outlines the system upon which this endeavour has worked and gives the results to date, but it points out that a great deal remains to be done before the fundamental economic argument underlying voluntary preference becomes really the actuating motive of the great body of consumers.

There are few signs, the Committee states, that the wholesalers have changed their sources of supply to meet the growing consciousness on the part of the public. It is, however, fair to recognise that apart from pressure from the ultimate consumers, the trader *quâ* trader, has no strong economic motive for breaking away from his old connections. It is for the producer to contribute to this economic motive. Attention is repeatedly drawn by the Committee to the necessity in different trades for improvement by producers in the technique of their production and in the organisation of their selling.

The large sum of money which is now being spent in creating a new habit of mind among customers carries with it obligations on producers to produce foodstuffs of the right quantity, of the right quality, and of the right price. The reports of the Committee—seventeen in number—have dealt principally now with this and now with that element in a trade—in some cases, for instance, they have been addressed chiefly to the growers, in others to the distributors, in order to bring out the defects and to demonstrate the lines upon which real develop-

ments may be made in the production and marketing of goods within the Empire.

The Committee directs attention to three suggestions of a general nature that emerge from these enquiries. Firstly, Empire producers require information as to what is taking place in their several trades. Early intimation of some of this information, such as seasonal crop prospects, movements of crops, changes in marketing methods, tariffs, export and import regulations, is needed. Other information is of value to producers who contemplate the investment of capital in new developments and accordingly desire to obtain an idea of the future demand for the product they propose to cultivate. The formation of an Intelligence Service organised trade by trade is suggested to satisfy this need.

Secondly, the Committee expresses the opinion that the creation and assimilation of Empire Standards in regard to many trades, both of primary production and manufacture, should greatly simplify the promotion of Inter-Imperial trade.

In the third place, the Committee expresses its hope that under the lead of the Economic Organisation of the League of Nations, further steps may be taken to secure that trade statistics compiled by the various Governments of the World be based on such common rules as will render them more truly comparable.

The above brief references to the opinions of the Imperial Economic Committee are stated in this place because it is realised that Malaya is essentially a primary producer and a great many of the investigations of the Committee have therefore a direct bearing on the industries of this country. In this connection we would especially bring to the notice of producers in this country the following reports of the Imperial Economic Committee which may be obtained from H. M. Stationery Office, Kingsway, London, W.C.2. The prices quoted include postage.

The Policy of Voluntary Preference (The First Report, 10d.)

A Memorandum on the Trade of the British Empire 1913 and 1925 to 1928 (Thirteenth Report, 7d.)

Fruit (Third Report, 4s. 10d.)

Agricultural Machinery (Eleventh Report, 8d.)

Rubber Manufactured Goods (Fourteenth Report, 8d.)

Malayan Pineapples at The Grocers' Exhibition. The Publicity Officer of the Malayan Information Agency, in the course of his report on the Grocers' Exhibition, Portsmouth, 1930, stated that the event provided fresh proof that the Malayan Pineapple is making material progress in popularity now that the question of grading and packing have been seriously dealt with and it may reasonably be expected that an important new field has been opened up for the exploitation of the product. At this exhibition, opened tins of fourteen brands of the Malayan product were displayed to enable visitors to judge by their own senses of the quality of our product. As the "G.A.Q." (Good Average Quality) did not as a rule open well, these specimens were mainly confined to "Golden Quality." *Indeed, the show furnished yet another indication that the presence on the market of inferior "G.A.Q." stuff acts as a handicap to the progress of the ripe, well-graded and well-packed fruit, for the public are*

liable to confuse one with the other.

We have italicised the above words of the Publicity Officer because we would take this further opportunity of urging those concerned with the production and marketing of canned pineapples in Malaya to use every endeavour to maintain a high quality of packing. Improvements in this direction have been effected but they are not sufficiently widely adopted.

A great deal of most useful propaganda work in popularising Malayan Pineapples is being accomplished at exhibitions in the United Kingdom. For instance, at the above exhibition forty-five applications were received for the addresses of importers of Malayan Pineapples. If the present market is to be held and expansion effected it is of first importance that the quality of the pack shall be maintained at the highest possible standard commensurate with the price.

The Coconut Census 1930 The International Institute of Agriculture, Rome, planned a World Agricultural Census to be taken in 1930. It was in connection with the agricultural returns of Malaya for this Census that arrangements were put in hand to collect data concerning the area under coconuts.

While the results do not claim the accuracy that was desired, they undoubtedly express a closer approximation of the total area and of the distribution of the coconut areas than we possessed before. This data will be of considerable value in the persuit of copra investigations at present being carried out by the Department of Agriculture.

The coconut census has shewn that the small-holders' share of copra production is larger than was anticipated, a fact that adds point to the consideration at present being given to improvements in production and marketing of copra from such areas.

Progress in Copra and Oil Palm Research Two articles in this number: viz: "Experimental Work in Relation to Oil Palms" by Mr. B. Bunting and "The Economic Aspects of Copra Research" by Mr. F. C. Cooke are reviews of the progress of experimental work in this country which the authors presented at the recent Inter-Departmental Agricultural Conference at Kuala Lumpur. It is hoped that the reader will appreciate the practical aspects of the work in hand on these two crops. Both of these industries are of considerable value to Malaya. We hope that as a result of scientific research in close relation with estates, Malaya's pre-eminent position regarding the quality of palm oil exported may be maintained, and that in liaison with producers and exporters of copra, considerable improvements may be effected in connection with the quality our exports of copra.

Original Articles.

THE ECONOMIC FACTORS OF COPRA RESEARCH.*

BY

F. C. COOKE,

Assistant Chemist for Copra Research.

Introduction.

The terms of reference of the copra research work that is being carried on in this country are as follows:—"......to determine what shall be the characteristics of a high-grade copra and by what methods of preparation suitable to large and small producers these characteristics can be secured."

This involves a careful stage-by-stage investigation of its preparation, storage and transport, commencing with the fruit and proceeding to the time when the copra arrives in Europe. The system of marketing, too, must be considered, as it has an extremely important bearing on the quality of the product leaving this country.

This report gives an account of the work done and of the enquiries made during the first of the four years allotted to this problem, while in the February issue of *The Malayan Agricultural Journal*, 1930, is to be found the programme originally outlined, and an account of the position up to 1929.

Economic Aspects.

At present, three grades of copra are recognised in Malaya:—

F.M.S.—Fair merchantable sundried. (Best)

F.M.—Fair merchantable.

"Mixed"—Unsorted native copra.

These grades are by no means sharply defined nor is "F.M.S." copra, the highest grade, by any means a perfect product. "Mixed" copra is the bulked product collected by the provincial dealers from the small-holders in small parcels of one or two piculs. The quality of such "mixed" copra in different districts varies considerably, but is more or less equally good or bad within any one district. Owing to the poor price paid by the local dealer to the producer, the copra he buys is almost invariably wet and frequently very carelessly prepared. The blame for this state of affairs is not entirely on the side of the dealer who must protect himself against the deterioration of such an inferior product, nor is it entirely the fault of the small-holder who has no incentive whatever to take

* First part of a paper entitled "The Present-day Position Relating to Copra Research and Practical Issues Concerned Therewith," presented at the Second Inter-Departmental Agricultural Conference held at Kuala Lumpur in October 1930. Part II "Factors of Quality in Copra" and Part III "Types of Malayan Copra" will be published in subsequent numbers of this Journal.

extra trouble, but rather the reverse.

Accordingly, the "mixed" copra when it ultimately arrives at Penang or Singapore has to be redried and resorted to prepare it for the home markets. The copra is carefully picked over and the best pieces are removed, the inferior copra being classed as of "F.M." quality.

The separated "F.M.S." copra cannot be perfect copra because it has been in contact with the badly prepared product. This sets a standard for "F.M.S." copra, however, and practically perfect copra which may be obtained from a few estates generally at a slight premium may sometimes be untilised to improve and bring the quality of unsorted "mixed" copra up to Straits "F.M.S." standard. Most estates, furthermore, produce a copra needing no redrying or sorting and wholly "F.M.S." quality.

The important point to recognise is that the "F.M.S." standard is both an inferior and a flexible standard. Should increasing amounts of low grade copra become available, the standard for sorting may be relaxed to meet the home demands for "F.M.S." copra. On the other hand, if by some system of co-operative marketing among the small-holders they are encouraged to produce an improved "mixed" copra, then the shippers will be able to sort more carefully and so evolve a higher standard for "F.M.S." copra. The opinion has been expressed both in England and in Malaya that the general standard of "Malayan" copra has fallen during the last ten years with the result that a discriminating price has been paid for the copra from this country. To illustrate the general decline in quality, two examples may be quoted :—

Imported (C)	Once 100 per cent. "F.M.S." now less than 50 per cent. "F.M.S."
East Coast, Malaya (A)	Once 50—70 per cent. "F.M.S." now 10—15 per cent. "F.M.S."

It is also fairly generally alleged that Straits "F.M.S." copra is inferior in appearance and oil content to Ceylon "F.M.S." copra. Analyses in this department have shown that whereas the oil content of Malayan estates copra lies between 65 per cent. and 66 per cent. (dry basis)[1], the oil content of selected samples of Ceylon copra contain about 68 per cent. of oil (dry basis). Furthermore, it has been confirmed that Ceylon produces a very good, thick, white copra.[2]

The difference in the price obtained for Straits "F.M.S." and Ceylon "F.M.S." copra is considerable and amounts sometimes to nearly £2 per ton, the price paid for each being nearly proportional to the percentage oil content, with a bias in favour of Ceylon copra because of its whiteness.

The price paid for the Straits "F.M." product is, of course, still lower, so that the annual loss to the industry by careless methods of preparation or other causes may be roughly estimated to be over £100,000 per annum on a nett annual export of 110,000 tons; this estimate, however, is based on price considerations alone and omits the heavy hidden losses of actual copra, by deterioration in

1. Georgi, M.A.J. September, 1929 page 335.
2. Bunting, M.A.J. August, 1930 page 390.

transit between the producer and the manufacturer who only pays for the actual weight of residual copra he receives.

The situation is aggravated by the influence of the large amounts of inferior copra, some unmarketable for home consumption, which are received in Penang and Singapore from outside sources. In Ceylon, the copra comes from what may be regarded as one source and the industry is easily administered. On the other hand, Penang receives its copra from about three districts in Malaya and at least four districts outside, while Singapore draws on six districts in Malaya and some nine outside sources.

Unfortunately also, almost any kind of copra can obtain a market and there is actually a keen demand for bad copra, rich in oil (see later) which is cheap and available in large quantities. At present, any quality sells, and the dealers are quite satisfied to make a profit on a poor grade of copra, so that at present a poor grade of "F.M.S." copra controls the market.

With no fixed general standard of quality and because the local dealers do not pay any premium for well-dried and well-prepared copra, it is not surprising that the quality of "mixed" copra obtainable in any one district is of the lowest acceptable quality for that district and the continued tendency on the part of the producer will be to include just as much water in his product as he can without its being noticed.

The difficulty sometimes to be faced is that insufficiently dried copra may, when first produced, appear to be of the highest quality. Well-dried copra frequently has a slightly yellow tinge, whereas half-dried copra may still be snow white. Several rough tests for estimating the moisture content can, however, be applied:—

(1) if the copra is excessively wet it usually becomes hot and "sweating" when stored in bulk;
(2) if the copra is sufficiently dried the pieces break crisply when bent;
(3) the width of the dark line seen on the fresh fractured surface is also a criterion of the moisture content;
(4) A thin slice of copra is lit with a match—
    (a) if it burns readily, the moisture is less than 7 per cent.
    (b) if the flame splutters, the moisture is about 7—10 per cent.; at 10 per cent. it burns with difficulty;
    (c) if the moisture in the copra is above this, the slice will not burn at all.

It may be asked: What is wrong with a wet copra supposing it happens to be of good appearance? The trouble with such copra is that it will not retain its apparent high quality. Heavy mould growth, insect attack and self-heating all combine to reduce the amount, quality and value of the oil that can be derived from the copra and the colour, sweetness and value of the derived cattle cake. The exceedingly low price paid by the local dealer is actually a reflection of the risk he takes in buying such an unreliable product.

In the first place, the local dealer has to pay for the transport of the extra

water; he also is only paid for the dry weight of copra received at Singapore; he bears the brunt of any depreciation in transit due to the contained moisture; and finally, the price he is paid by the shipper is discounted on account of the cost of redrying and resorting at Penang or Singapore.

Thus, we have arrived at a deadlock in which the market is organised to expect an inferior product and pay for it at a very discriminating price. Whatever the small-holders may have to say about the price paid to them, nothing can be done for them until they combine and determine first to produce a better product, and then to study the market so as to obtain the best possible price for their product. Meanwhile, it does not pay a dealer to consider very small lots of well-prepared and well-dried copra.

In order to give a clear idea of the situation, the present system of buying and selling native copra must be briefly outlined. At the beginning of September, 1930, when the price paid for "mixed" copra at Singapore was about $6.50 per picul (133⅓ lbs.) the prevailing price in one district where is produced what may safely be described as the finest "mixed" native copra dealt with in Malaya was only $4.00. It must be admitted that even this copra was unnecessarily wet, since many of the producers were kiln drying for only 24 hours; while others adopted a kiln drying period of three days but obtained no added reward. The average small holding is about three acres and the nuts or, in a few cases, the copra produced are sold to a small local dealer with whom the producer frequently has a more or less permanent debt. This small dealer transports the copra by road to a bigger dealer who proceeds to ship the material by "tongkang" to Penang or Singapore where it is generally sold to yet another dealer who in turn bulks the material and sells to the big shipper.

The shipper dries the material for two or three weeks, weighs it and either pays for it at "mixed" prices or else sorts it into "F.M." and "F.M.S." grades, paying for each separately at the prevailing price. (If the "mixed" copra is wholly of bad "F.M." quality a special penalty is applied). While this represents a more or less extreme case of handling the material, the extreme difference in price between producer and shipper of $2.50 per picul is made up as follows:—

(1)	Old bags	20 cents each.
(2)	Motor transport to the nearest port	20 cents.
(2)	Export duty	12 cents.
(4)	Shipping: nearest port to Singapore or Penang ...	35 cents.
		87 cents.

However, the high moisture content affects the issue very considerably and may be taken as equivalent to an added charge of 50 cents a picul so that the various middlemen share something between $1 and $1.50 per picul at existing

prices, though considerably more in better times.

The question that now arises is whether a good proportion of this profit cannot be transferred by better production and organised co-operative marketing into the pockets of the producers who, at present prices paid to them for their nuts and their copra, are experiencing very lean times. Particularly in view of the adverse world prices for edible oils, and the possibility of a continuance of low prices, every effort should be made to secure the best possible market and the best local bargain and to advance the quality so that Malayan copra may never fail to obtain a market.

THE MALAYAN COCONUT CENSUS, 1930.

BY

D. H. GRIST,

Agricultural Economist.

No census of the coconut areas of Malaya has been attempted since 1924, when the results of such a census were published by the Economic Botanist in *The Malayan Agricultural Journal,* Vol. XIII, No. 6.*

In the 1930 Coconut Census, an attempt has been made to differentiate small holdings—which may be taken to supply local demand for fresh nuts—from the larger areas from which one may reasonably expect coconut products in commercial quantities. The former areas generally consist of coconuts interplanted with other crops—frequently rubber—and as a rule yield fewer nuts per palm than do those in the second category.

The actual census of areas under 100 acres each was, in most instances, taken by local headmen, who submitted lists of names of owners, particulars of their grants, and the area of coconuts if planted as a sole crop, or the number of coconut palms on each holding if in a mixed plantation. In each case returns were submitted of mature and immature areas separately.

The returns of areas on large estates were, as a rule, obtained as a result of written request to the managers or owners.

Returns were examined by the District Administrative Officers and/or by the Agricultural Field Officers. In a number of cases the latter officers instituted checks on the returns, before submitting them to the Division of Economics. In cases of doubt further checks of the returns were instituted by the Division.

The scheme worked fairly well for the Federated Malay States and Straits Settlements. It is probable that the returns are underestimated, possibly to the extent of from 5—10 per cent.

The position with respect to the Unfederated Malay States—especially Johore, Kelantan and Trengganu was unsatisfactory and the figures from these States are little more than estimates. Incomplete settlement and survey work and the lack of responsible headmen are among the causes of this unsatisfactory result.

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* The following are the figures of the 1924 census of coconuts in Malaya.

Federated Malay States.		Straits Settlements.		Unfederated Malay States.	
Perak ...	75,281 acres	Singapore ...	6,565 acres	Johore ...	92,500 acres
Selangor ...	62,117 „	Malacca ...	45,000 „	Kedah ...	27,550 „
Negri Sembilan ...	6,604 „	Dindings ...	6,000 „	Kelantan ...	70,900 „
Pahang ...	19,400 „	Province Wellesley ...	55,000 „	Trengganu ...	8,000 „
		Penang ...	15,000 „	Perlis ...	2,578 „
Total F.M.S.	163,402 acres	Total S.S.	127,565 acres	Total U.M.S. ...	201,528 „

Total Malaya 492,495 acres.

Federated Malay States.

Records were obtained of 87,507 coconut holdings in the F.M.S. Of these 41,246 are in Perak, 22,610 in Selangor, 11,478 in Negri Sembilan and 12,173 in Pahang.

Of the large estates, 28 exceed 1,000 acres each, two of which exceed 5,000 acres each; 54 are between 100—1,000 acres each; 2,048 are between 5 and 100 acres each; and 21,005 under 5 acres each. The number of small holdings of mixed cultivation, including coconuts, number 64,372.

A summary of the areas under coconuts in the F.M.S. is given in the accompanying table. The figures for areas under 100 acres each include the counts of trees in mixed holdings which are here computed in acres on the basis of 50 palms per acre. These mixed areas amount to an estimated area of 16,487 acres immature and 29,511 acres mature coconuts. These areas may be considered as "ineffective" as the yields in most cases are small and are generally utilised locally. The "effective" area under coconuts in the Federated Malay States is therefore 55,582 acres immature and 138,150 acres mature.

Straits Settlements.

Administrative difficulties precluded an accurate census of the area under coconuts in Singapore island. The area, however, is not sufficiently great to affect the value of the returns from the Colony.

Excluding Singapore, particulars of the areas of 49,603 owners were received from the Straits Settlements and were analysed. Of these, 7 are estates of between 1,000 and 2,000 acres each; 56 are estates of from 100 to 1,000 acres each; 1,000 are holdings between 5—100 acres each; there are also 6,403 holdings under 5 acres and 42,137 small holdings of coconuts mixed with other trees.

Of the total area under coconuts in the Colony, 5,662 acres immature and 28,305 acres mature represent the esimated "ineffective" areas of small holdings of mixed cultivation. The "effective" coconut area in the Straits Settlements is therefore 6,184 acres immature and 41,896 acres mature.

Unfederated Malay States.

Kedah. The returns from this State are reasonably complete. The total number of coconut holdings is 36,129 of which no less than 35,659 are small holdings of coconuts and other trees. On a basis of 50 palms per acre the number of coconuts contained on such holdings would be represented by 7,981 acres immature coconuts and 15,528 acres of mature coconuts. The estimated total area of coconuts in Kedah is 26,688 acres of which 8,814 acres are immature and 17,874 acres mature. There are but 5 estates of over 100 acres each, the largest being less than 300 acres.

Perlis. There are no large coconut estates in Perlis. In addition to the areas of coconuts unmixed with other forms of cultivation, 49,939 immature and

101,777 mature palms were counted on holdings containing other trees also. The area represented by these palms has been computed at the rate of 50 palms per acre.

Johore. The Principal Agricultural Officer, Johore, is responsible for the coconut returns from that State. The following facts are drawn from his report on this subject.

The chief difficulties encountered were that neither land alienation nor the headman system were sufficiently perfect and a large number of coconut holdings are still unsurveyed.

Consequently, the coconut census forms prepared for this work could not be used in Johore. The estimate was prepared by production of a map shewing distribution of coconut areas; examination of figures for the export of copra from various district; and the examination of various agricultural records.

There are 90,750 acres of mature coconuts and 29,350 acres of immature coconuts contained in large areas. The produce from such areas is mainly available for export.

Of large areas of coconuts mixed with rubber, fruit trees and other forms of cultivation, there are 41,250 acres mature and 3,700 acres immature. It is estimated that the yield capacity of such areas is from 20—40 per cent. of similar areas of coconuts alone growing under corresponding conditions.

There are very few large coconut estates in Johore. Twelve estates only are said to have an area exceeding 100 acres each. One of these estates exceeds 1,000 acres and one has between 600—700 acres.

Areas of scattered palms are found in great numbers. The produce of such palms is absorbed locally and none is available for export. No estimate of the acreage represented by this "ineffective" area has been attempted.

It is estimated that there are 30,000 individual coconut holdings in Johore and that the number of coconut palms is in the neighbourhood of 7,000,000 of which 5,000,000 are mature.

Kelantan. Records have been received of particulars of 40,072 holdings containing coconuts. The total number of trees on such holdings amounts to 287,990 immature and 742,674 mature palms, in addition to an area of coconuts unmixed with other crops of 1183 acres. On a basis of 50 palms per acre, this is equivalent to 21,797 acres.

The Kelantan Government estimates the total area at 57,271 acres. The 1929 exports of copra from the State amounted to 122,187 piculs (7,187 tons). In view of the fact that records exist of nearly 6,000 acres of immature palms, that there are no large coconut estates—in fact that much of this copra must originate from small holdings of mixed cultivation—it may safely be assumed that the official returns are not over-estimated.

Trengganu. Owing to the undeveloped condition of this State, reliable statistics could not be obtained. Apart from one estate, the coconut holdings are small and frequently interplanted. The figure of 25,000 acres must be considered as little more than an approximate estimate.

AREA OF COCONUTS IN MALAYA 1930.

	STATE OR TERRITORY.	IMMATURE. On Holdings of Over 100 acres each.	IMMATURE. On Holdings of Under 100 acres each.	Total Immature area (Acres).	MATURE. On Holdings of Over 100 acres each.	MATURE. On Holdings of Under 100 acres each.	Total Mature area (Acres).	Total (Acres).
Federated Malay States.	Perak	11,476	14,196	25,672	37,664	45,604	83,268	108,940
	Selangor	5,398	35,519	40,917	32,429	36,948	69,377	110,294
	Negri Sembilan	155	1,121	1,276	914	3,776	4,690	5,966
	Pahang	256	3,948	4,204	2,456	7,870	10,326	14,530
	Total F.M.S. ...	17,285	54,784	72,069	73,463	94,198	167,661	239,730
Straits Settlements.	Singapore	...	...	...	3,159	4,841	8,000	8,000
	Malacca	...	2,330	2,330	...	10,255	10,255	12,585
	Dindings	893	1,696	2,589	1,764	2,177	3,941	6,530
	Province Wellesley ...	2,183	1,438	3,621	15,415	17,785	33,200	36,821
	Penang	308	359	667	2,936	9,923	12,859	13,526
	Labuan	...	1,958	1,958	...	1,238	1,238	3,196
	Brunei	...	681	681	...	689	689	1,370
	Christmas Island	...	...	...	...	19	19	19
	Total S.S. ...	3,384	8,462	11,846	23,274	46,927	70,201	82,047
Unfederated Malay States.	Johore	428	32,622	33,050	2,873	129,127	132,000	165,050
	Kedah	361	8,453	8,814	492	17,382	17,874	26,688
	Perlis	...	1,434	1,434	...	2,527	2,527	3,961
	Kelantan	...	...	...	...	...	...	57,271
	Trengganu	...	...	...	...	...	...	25,000
	Total U.M.S. ...	...	...	...	...	...	...	277,970
Grand Total ...	Malaya							599,747

Conclusions.

The area of coconuts in Malaya is approximately 600,000 acres. Of this area about one-fifth consists of estates of over 100 acres each. The proportion of immature to mature coconuts is about one-sixth.

Of estates over 1,000 acres each there are 28 in the Federated Malay States, 7 in the Straits Settlements and one in Trengganu.

In all parts of the Peninsula are to be found small holdings of mixed cultivation and small groves of coconut palms. These are mainly used to satisfy local demand and are not as a rule of economic importance. In the Unfederated Malay States, however, and particularly in Kelantan, a considerable amount of copra originates from such areas.

Local consumption, coconut oil exports, exports of fresh nuts and immature areas are represented by about 200,000 acres, leaving approximately 400,000 acres to produce the Malayan export of copra. Allowing an under-estimate in this census of area under this crop of 10 per cent. the mature area therefore gives an annual crop of 4.6 picul (about 600 lbs.) per acre.

EXPERIMENTAL WORK IN RELATION TO OIL PALMS.*

BY

B. BUNTING,

Agriculturist.

Introduction.

In view of the increasing importance of the oil palm industry in Malaya the Department of Agriculture, S.S. & F.M.S. has devoted a considerable amount of attention to practical investigations connected with the cultivation of this comparatively new crop to Malaya.

A fairly large experimental area has been planted with oil palms at the Experimental Plantation, Serdang for the purpose of investigating the various problems concerning the cultivation of this crop on a plantation scale, and it is proposed in this paper to give a brief account of the experimental work now being carried out by the Agricultural Division of the Department both at the Experimental Plantation, Serdang and on estates owned by public companies.

Seed Selection.

Although male and female inflorescences are produced separately on the same palm it is extremely rare to find both male and female inflorescences on a single palm simultaneously in a condition suitable for pollination. Consequently, the natural tendency of the palm is to become cross-fertilised with pollen from another palm and when it is required to "self" a particular palm it is invariably necessary to keep the pollen for long and indefinite periods until a female inflorescence becomes receptive. This means that the stored pollen has frequently lost its viability by the time the female inflorescence is ready to receive it, with the result that self-pollination by artificial methods is not very successful.

Experiments have been carried out at Serdang in the crossing and "selfing" of ten of the highest-yielding palms growing under avenue conditions with the result that to-date 69 distinct crosses and 4 "selfs" have been successfully established from known parentage. Arrangements are now being made to plant half-acre plots of each cross and "self" on a field scale in Blocks 10a, 17 and 18 in order to ascertain whether the high-yielding characters of the parents, grown under avenue conditions, are maintained in the progeny when grown under normal plantation conditions. Control palms, which have been produced under ordinary estate conditions, will be planted between every four rows of the selected palms for purposes of comparison when the palms come into bearing.

* Paper read at the Second Inter-Departmental Agricultural Conference held at Kuala Lumpur in October, 1930.

Records have been kept of the individual yields of the palms from which the various crosses were produced. These records were commenced when the parent palms first began to fruit in August, 1924 and are being continued.

It is fully realised that too much significance cannot be attached to the abnormally high yields which have so far been recorded on palms growing under somewhat exceptional conditions. In consequence, this experiment will be repeated with crosses from high-yielding palms growing under normal plantation conditions. With this object in view, an area of about 2 acres of palms planted in November, 1924 has been selected in Block 21; the yield of fruit has been recorded from each individual palm in this area since January, 1929 when the palms came into bearing. It will, however, be necessary to take records of such yields for a number of years before selecting the highest yielding palms for this purpose.

Introduction of New Varieties.

With a view to obtaining improved types of oil palm, the Department introduced during 1926 no less than 40 different lots of seed from the various palm oil producing countries in West Africa.

An area of 33 acres in Block 19 has been devoted to varietal trials and 32 plots, varying from ½ to 1 acre of each variety, were planted in this area between November, 1927 and April, 1928. These palms are now commencing to fruit and it will be most valuable to make a comparison of the different types of fruit produced with such a varied selection of palms cultivated under the same conditions.

It may be of interest to record that included in the collection is the "mantled" type, the pericarp of which is covered with sterile carpels containing oil. The entire fruit is stated to contain a higher percentage of pericarp oil than is found in the ordinary "Deli" type commonly planted in the East Indies.

The establishment of such a varied collection of palms should prove of great value in future work on seed selection, which will eventually be carried out at Serdang in collaboration with the Botanical Division of the Department.

Cover Crops and Green Manures.

The advantages of cultivating a low-growing cover plant on hilly or undulating land for the prevention of soil erosion cannot be disputed, but experiments carried out at Serdang indicate that, with oil palms growing on flat land, not liable to soil wash, such cover plants have a tendency to retard fruit production.

An area of young oil palms in Block 21 has been planted in 1 acre plots with *Calopogonium mucunoides, Centrosema pubescens, Tephrosia candida* and *Crotalaria anagyroides* and an equal area is reserved for clean-weeded controls. The covers were removed during 1929 and the yields of fruit from the various plots have been recorded since that date.

The records for the period 1927 to 1929 show that the total yield of fruit

from the clean-weeded plots is slightly in excess of that obtained from the plots formerly under cover crops and green manures as detailed below :—

	Number of bunches.	Weight of cleaned Fruit.
(a) Cover plants ...	7,031	65,469 lbs.
(b) Clean-weeded control...	9,326	79,231 lbs.

Although these experiments are probably insufficiently advanced to give definite information as to the effect of covers on the ultimate yield of oil palms, the tendency at present is in favour of clean weeding on flat land.

Another serious objection to the cultivation of low-growing cover crops such as *Calopogonium mucunoides* and *Centrosema pubescens* is the danger of harbouring vermin, notably rats, which have become a very serious pest on the majority of oil palm estates in this country.

Germination.

Further experiments are being conducted at Serdang to compare the germination of seeds obtained from bunches harvested as in estate practice with that of seed obtained from fallen fruit. The results so far do not indicate that seed taken from fallen fruits give a higher percentage germination than seed harvested in the ordinary way. These experiments will be repeated on a larger scale at a later date if necessary.

There is no doubt that the germination of oil palm seed is liable to wide variation and whether this is due to the method of harvesting the fruit or to other causes requires closer investigation.

Interplanting Rubber with Oil Palms.

On the recommendation of the Agricultural Advisory Committee, an experiment was laid down on an area of approximately 9 acres in Block 20B at Serdang to test the effect of interplanting oil palms with rubber.

The area was planted with oil palms 30 ft. x 30 ft. triangular, or 56 palms per acre, in January, 1926 and afterwards interplanted with an equal number of rubber stumps per acre.

The following measurements, taken in January, 1930, show the development of the palms in this experiment compared with that of palms planted as a sole crop in a similar area in Block 5A :—

	Block 20B.	Block 5B.
Average height	15 ft.	20 ft.
„ spread	20 ft.	28 ft.
„ circumference ...	6½ ft.	8 ft.

The following measurements, taken in October 1930, show the development of the rubber in this experiment :

Average height	30 ft.
Average circumference at 2 ft. from ground	19 inches

The growth of the rubber has obviously been retarded by the more rapid development of the oil palms, which so far appear to have a decided advantage over the rubber trees.

Pruning of Leaves.

Experience has shown that the pruning of the leaves of young oil palms should be restricted to the removal of those leaves which have dried and therefore ceased to function. If this practice is adopted it will result in the young palms forming a good-sized trunk, thus providing a suitable base for future development.

In order to test the effect of excessive pruning of the leaves of palms in bearing, an area of approximately 2 acres was selected in Block 5D at Serdang. There were 100 five-year old palms included in this experiment and these were divided in four equal plots as follows:—

Plot 1 = 25	palms, pruned at the rate of	3	leaves	per month.
Plot 2 = 25	do.	2		do.
Plot 3 = 25	do.	1		do.
Plot 4 = 25	„ control (normal pruning).			

The experiment proved that the removal of three leaves per month was far too drastic, and after a period of 18 months this system of pruning had to be abandoned; even the removal of two leaves per month was considered excessive, since the palms tend to produce new leaves more rapidly and to increase in height at the expense of girth. On the other hand, the removal of one leaf per month was insufficient and resulted in dead leaves accumulating on the palms. The operation of pruning should, therefore, be restricted so as to allow of harvesting the fruit bunches and the removal of any dead leaves.

A further experiment to test the effect of (a) normal, and (b) minimum pruning of leaves on the yield has been laid down on an area of about 4 acres in Block 21. There are 252 palms included in this experiment, the two forms of treatment being alternated in 36 rows of 7 palms each.

The ill-effect of excessive pruning is now generally recognised and, in order to conserve the energies of the palm, only the minimum amount of pruning should be carried out.

Removal of Female Inflorescences from Immature Palms.

The harvesting of fruit bunches should be deferred until the palms are at least 4 years old, although a large number of small bunches are produced when the palms attain the age of 2½ to 3 years. As these are allowed to remain on the palms until they become over-ripe and fall, they are not only liable to attract rats but may become a possible source of infection of *Marasmius* or other fungoid diseases affecting fruit bunches.

Because of the possible dangers attending the premature production of fruit bunches, an experiment was started on an area of approximately 8 acres in Block 20B to test the effect of the removal of female inflorescences before regular harvesting of fruit commenced. The experiment was made on 480 palms and the female inflorescences were removed from every alternate row from August, 1928, to December, 1929 the intermediate rows being retained as controls.

The results show that there has been no increase in the number of inflorescences produced as a result of removing the female inflorescences. Further, the development of the treated palms has not been affected in any way and has been very similar to that of the untreated controls. Records of the yield of fruit bunches are now being taken from the series of plots in order to ascertain whether there has been any conservation of vigour in the palms which were prevented from fruiting in the early stages of development (by the removal of all female inflorescences as soon as they appeared).

Manuring.

It is now realised that the question of manuring oil palms will have to be considered as the palms become older, if satisfactory returns are to be obtained.

At present, little is known about the manurial requirements of the palm. With a view to investigating this important subject the Department has inaugurated a scheme of experiments which is now being carried out on blocks of about 8 acres on Tennamaram Estate, Batang Berjuntai; 4 acres on Elmina Estate, Sungei Buloh and 2 acres at the Experimental Plantation, Serdang.

In these experiments each block is limited to 120 palms divided into six plots of 20 palms each. A guard row of palms separates one plot from the other, but the yield of fruit from the guard rows is not recorded since they are only included to ensure proper isolation of the various plots in the experiment.

In order to obtain a measure of the respective yields of fruit obtained from the different plots, preliminary observations were made of the production of fruit bunches from each individual palm comprised in the experiment for a period of 1½ years. The preliminary records before manurial treatment were commenced in January, 1929 and completed in June, 1930. A statistical examination of the figures obtained showed that it was necessary to reduce the size of the plots in each case from 20 to 10 palms, thus providing 12 plots in each block instead of 6 as originally arranged.

After completing the preliminary records, all the plots were lightly cultivated and artificial manures were applied to eight plots in July, 1930, the remaining four plots in each block being retained as controls.

There are two blocks under trial on Elmina Estate and four blocks on Tennamaram Estate, which gives four and eight replications respectively on each estate. The manurial treatment for each block on these estates is as follows:—

2 plots = Nitrogen, phosphate and potash.
2 „ = Nitrogen and phosphate.
2 „ = Phosphate and potash.
2 „ = Nitrogen and potash.
4 „ = Controls (untreated).

It was decided in the first instance that quick-acting mineral manures should be applied and that the standard mixture should consist of 2 lbs. of suphate of ammonia, 6 lbs. of superphosphate (18 to 20 per cent.) and 2 lbs. of sulphate of potash, divided into two applications at intervals of six months, namely in July and January.

The plots are randomised in order to check any variation in soil conditions so that the manurial treatment of the similarly numbered plots in each block is not necessarily the same.

For convenience of record, arrangements were made to harvest the fruit on these plots at regular intervals of 7 days and an officer of the Department visits both estates weekly and takes records of the yield of fruit bunches from each individual palm in the experiment.

A similar scheme of experiments was laid down in Block 21 at Serdang in January, 1929. The preliminary records of yields on these plots, although showing considerably less variation than those of the plots on the two estates mentioned above, indicated the necessity for reducing the size of the plots from 20 to 10 palms per plot in order to reduce the experimental error.

The scheme of manuring on this block differs slightly from that carried out on the estates in order to allow of three replications of the manurial treatment, which is as follows :—

3 plots = Nitrogen, phosphate and potash
3 „ = Phosphate and potash
3 „ = Phosphate
3 „ = Controls (untreated)

The standard mixture was the same as that used on the estates, namely 2 lbs. sulphate of ammonia, 6 lbs. superphosphate (18 to 20 per cent.) and 2 lbs. sulphate of potash, divided into two applications at intervals of six months. The first application was made during August, 1930 and the halves of the guard rows on each side of the manurial plot received the same manurial treatment as the plot itself.

Since it is proposed to manure the plot every two years, it should be possible either to increase or reduce the respective quantities of nitrogen, phosphate and potash, or alternatively, to substitute other forms of nitrogen, phosphate or potash while still retaining the original combination of plant nutrients in the respective plots.

It will be realised that the present scheme of manuring is purely experimental and that it may be found necessary to make considerable changes in the programme as further information is obtained.

Artificial Pollination.

There are considerable differences of opinion amongst planters as to the necessity or otherwise of carrying out artificial pollination of oil palms in order to obtain the maximum yield of fruit.

The Department has given careful attention to this important problem and much valuable information has been collected as a result of the experiments which have been carried out, both at the Experimental Plantation, Kuala Lumpur and later at the Experimental Plantation, Serdang.

An experiment in the artificial pollination of oil palms, growing under avenue conditions, has been in progress at Serdang since August, 1924. The palms in this experiment were planted in May, 1922. The distance of planting is 30 feet apart while the two rows forming the avenue are situated 36 feet apart. The first male spadix appeared in May, 1923 and the first female inflorescence early in December 1923.

The palms were divided into two blocks and forty-three palms on one side of the avenue were pollinated artificially, while a similar number of palms on the opposite side of the avenue served as controls. Artificial pollination was carried out from the 1st. August, 1924 and records of the yield of fruit from each individual palm have been taken since January, 1925. It should be stated that in this particular experiment artificial pollination is restricted to one female inflorescence per month as a maximum.

The following is a summary of the yields of (a) the weight of fruit bunches and (b) the weight of cleaned fruit from the two sets of palms for the period 1925 to 1929:—

	Artificially Pollinated lbs.	*Naturally Pollinated lbs.*
Weight of bunches	39,287	15,498
Weight of cleaned fruit	25,707	5,965

It will be seen from these figures that the pollinated palms show 15 per cent. increase in the weight of bunches and 330 per cent. increase in the weight of cleaned fruit over the unpollinated control.

Whereas too much significance cannot be attached to the wide difference in the yield due to the artificial pollination of young palms growing under avenue conditions, the results obtained from this experiment have been of material value in the laying out of further experiments in the artificial pollination of palms growing under normal field conditions.

An experiment in the artificial pollination of oil palms growing under field conditions was started in Block 5D at Serdang in January, 1926 on an area of approximately 20 acres of palms planted 30 ft. x 30ft. triangular in May, 1922. In this experiment the pollinated and control palms are in alternate rows in the

area under experiment. There are 68 rows of palms included in the experiment and the odd numbered rows are pollinated artificially, while the even numbered rows serve as controls. Artificial pollination was commenced in January, 1926 and has been carried out continuously since that date.

The palms receiving artificial pollination are patrolled every alternate day and a maximum of one female inflorescence per palm is pollinated every five weeks, which gives approximately ten pollinations per palm per annum. The fruit bunches are harvested every 7 days and a monthly record has been kept of the total number and weight of fruit bunches of (a) the artificially pollinated palms and (b) the unpollinated palms since October, 1926.

The following figures show the total weight of fruit bunches obtained from each plot for the period October, 1926 to June, 1930 :—

Year.	*Pollinated Palms.*	*Control Palms.*	*Increases.*
	lbs.	lbs.	(per cent.)
1926 (3 months)	7,979	3,371	136.6
1927	37,234	18,061	106.1
1928	63,870	28,912	120.9
1929	91,645	49,806	84.0
1930 (6 months)	62,656	29,581	111.1
Total	263,384	129,731	103.0

During the above period the pollinated palms produced 14,514 fruit bunches giving an average weight of 18.1 lbs. per bunch, whereas the unpollinated control palms produced 11,737 fruit bunches giving an average weight of 11.1 lbs. per bunch or a difference of 7.0 lbs. per bunch in favour of the artificially pollinated palms.

The results clearly indicate that a considerable increase in fruit production is obtained by adopting artificial pollination in the case of young palms. It is intended to continue the experiment in order to ascertain whether this large increase in yield, due to artificial pollination, is maintained as the palms increase in age.

The ill-effects of over-pollination are now being recognised in estate practice and on some estates where the area was formerly patrolled regularly every three days for artificial pollination this interval has now been increased to seven days without any adverse effect on the yield of fruit.

It is considered that if artificial pollination can be restricted to the pollination of only one female inflorescence per month on each palm, far better results would be obtained and the crop would tend to be more evenly distributed. An experiment with this object in view has been started in Block 21 at Serdang. In this experiment the effect of pollinating (a) six, (b) twelve, and (c) all female inflorescences annually is being compared with (a) unpollinated control. This experiment is not sufficiently advanced to show the effect of the various treatments.

Harvesting of Fruit.

Although the oil palm commences to fruit about the third year after planting it is not advisable to commence harvesting until about the end of the fourth year.

The bunches of fruit are usually ripe and ready for harvesting within a period of 5½ to 6 months from the date of pollination, but if a dry spell of weather intervenes during the latter stages of development this period may be extended for about another month. The fruit ripens throughout the year but the crop during the highest yielding months, August and September, may be from three to four times that of the lowest yielding months, January and February.

The bunches are ready for harvesting when several fruits in the crown become loose and can easily be removed. The importance of harvesting only ripe bunches cannot be emphasised too strongly, since the collection of either unripe or over-ripe fruit will not only result in a serious loss of oil, but will cause an increase in the content of free fatty acids in the oil.

Previously, the harvesting at Serdang was carried out twice a week, but the tendency was to harvest immature bunches with the result that it was found difficult to separate the fruit from the bunches. Harvesting is now being carried out once a week and the bunches are harvested six days before the cleaned fruit is treated in the factory.

Harvesting the bunches and allowing them to ripen at the base of the palm doubled the acidity of the oil and it was found necessary to erect collecting sheds in the field so as to protect the fruit from rain.

The average weight of a bunch over the whole plantation for the first 8 months of the year 1930 was 15.6 lbs. and at present about 50 per cent. of this represents cleaned fruit. The amount of oil recovered is approximately 25 per cent. of the weight of cleaned fruit.

Conclusions.

Although it is too early to form any definite conclusions on the experimental results so far obtained, considerable progress has been made in many directions from a practical standpoint and this information is now being successfully employed in general estate practice throughout the country.

CONTROL OF MOULDY ROT DISEASE OF RUBBER.

BY

F. BEELEY, B. SC. (LEEDS)

Field Officer, Rubber Research Institute of Malaya.

In an account in the Quarterly Journal of the Rubber Research Institute, Vol. 1, No. 4 of the occurrence and life history of the casual fungus *Sphacronema fimbriatum* (E and H.) Sacc., the importance of maintaining an open, healthy, dry atmosphere within the plantation is emphasised. Thinning out to a less dense stand of trees per acre, good drainage, clean weeding or low growing cover crops where such are necessary to preserve top soil on hill slopes, ring weeding such trees, shallow tapping during wet weather, clean knives, cups and spouts, and the occasional sterilisation of all utensils used in tapping are factors which tend to minimise the possibility of occurrence of the disease.

It is further pointed out that optimum growth of the fungus takes place at temperatures from 22°C to 26°C while at a higher temperature growth is retarded until at 35°C the fungus is killed. If follows, therefore, that in a small holding were secondary jungle growth, 'lalang' grass and high weeds are present, the temperature of the damp bark surface being about 25°C, the fungus will be more vigorous and cause far greater damage than would be the case if the area was clean weeded to enable the bark surfaces to become dry.

One of the essential points in the treatment of Mouldy Rot is that the weeds or covers be closely slashed, or that clean weeding be adopted.

It is known also that Mouldy Rot is less active in dry weather than in wet weather. Attention to drainage will not only aid in controlling the disease, but will greatly improve the trees. Having given the necessary attention to the sanitary conditions within the holding, the affected trees must next be considered.

Firstly, all bark scrap should be removed before applying fungicide. The vertical channel, spouts and cups should be cleaned and overflowed rubber on the panel below the cut should be removed. Films of coagulated latex serve as a medium and protective cover for the fungus through which the disinfectant may not penetrate. Tappers on infected areas should have their knives and utensils sterlised and all trees in other areas tapped by the same tapper should be sprayed with one of the preventive sprays mentioned below.

Having cleaned the panel and burned all infective scrap material, the disinfectant may then be applied. The method of application and area of panel to be disinfected requires careful consideration.

Where the disease has been present for several days or longer, it is likely that rain has washed numerous spores into the interstices of the bark below the cut and the bark near the vertical conducting channel. It is, therefore, almost useless to paint a narrow strip of the renewing bark, and the best result which may be expected from this method is merely that of temporary relief. Experiments in heavily infected small holdings have repeatedly demonstrated the use-

lessness of strip painting.

In order to eradicate the disease it is essential to spray all the panel to the ground from a point some 12 inches above the cut, including the vertical channel. It will be realised that the use of a brush, coconut husk or rag will make this procedure somewhat tedious, wasteful of time and material, and ineffective. The most economical, rapid and efficient method is to use a small hand sprayer, or if large areas are to be treated, a knapsack sprayer fitted with a fine spray jet. A fine spray will penetrate into the interstices of the bark and will enable the operator to cover a larger area in a given time, while the quantity of liquid used is less than by other methods and the disease is less likely to reappear owing to the more thorough disinfection of the bark.

It is desirable that infected trees be taken out of tapping for one month, but circumstances may arise where tapping is essential to maintain the yields of the estate for commercial purposes; in which case, freshly cut portions of the panels must be painted with disinfectant after each tapping, following the proper treatment.

The following disinfectants may be used in the manner described :—

Izal.—A 3 per cent. mixture of Izal in water may be used applied by means of a sprayer to the whole panel, giving three applications with one day interval between each. Tapping should be stopped for one month. If it is necessary to keep the trees in tapping, three applications should be given on the whole panel as above, and the freshly cut cortex should be painted each day for one month at the time the latex is collected.

Brunolinum Plantarium.—A 5 per cent. mixture should be applied in the same manner as described for Izal. A little methylene blue (1 oz. in 10 gals.) added to the above colourless disinfectants will assist in checking the work of disinfection.

Agrisol.—A 5—10 per cent. mixture in water should be applied as described for Izal. If the weather is wet, the stronger mixture should be used.

Cargilineum B. Mixture (10 per cent.)—This is an "insoluable" compound withstanding wet weather. It is in paste form and cannot be applied by spraying; a brush must be used. The applications, covering as much of the panel as possible, with an interval of 7 days, have given results equal to those obtained by using the water miscible disinfectants described above. If tapping is to be continued, the freshly cut cortex must be painted with the disinfectant each tapping day for one month.

If the weather is wet, or as an additional precaution, the water miscible disinfectants may often be followed with advantage by a coating of water-

proof disinfectant medium applied to the affected panel some 6 inches above and below the cut. Four such water proofing mixtures are as follows :—

50 per cent. Asphaltum, 10 per cent. Brunolinum 40 per cent. Kerosene.

10 per cent. Brunolium in 90 per cent. Tar.

10 per cent. Solignum in 90 per cent. Tar.

Cargilineum Mixture " B " 10 per cent.

Any of these four mixtures may take the place of the third application of the water miscible disinfectant, and should be applied only when the surface of the panel is dry.

Selected Article.

SISAL FOR TEXTILE AND ALCOHOL INDUSTRIES.*

BY

Percy Ripley.

The history of sisal, if we use the name to include all members of the agave family of plants, extends over a century or so, and indeed, desultory cultivation by pioneers curious as to the plant's properties is recorded as far back as the end of the eighteenth century. But sisal received little attention from a practical point of view until within the last fifty years, and even at the present time its commercial possibilities have been explored only in a few directions. Sisal is a generic term, and it should be explained that when sisal is named without qualification the reference is to *Agave sisalana,* as distinguished from the Mexican plant henequen and its several varieties, all really members of the sisal family, and as distinguished also from the hemps of Manila, Mauritius, and New Zealand, which also belong to the same natural order as sisal.

A hardy plant, requiring little cultivation, resistant to the attacks of most diseases and to all but the most voracious of animals, sisal originated in Central America, from which it has been introduced into some thirty countries. Its cultivation in many of these countries, which are situate in four continents, is still at an experimental or relatively unimportant stage. Such is the stage reached in Australia and Malaya; in other areas, as, for example, the Caicos Islands, the cultivation of sisal, though on a comparatively small scale, has proved a valuable addition to the scanty means of livelihood otherwise available to the inhabitants.

Africa is the most important producer of sisal, and notably Tanganyika and Kenya. Exports of sisal from East Africa during 1929 were of a value of over £2,000,000, and further expansion in exports is only a matter of the provision of additional capital for the development of estates. The introduction of sisal to Africa was the result of German foresight, and until the war the cultivation of sisal was a part of German colonial policy. . Since the war the industry has passed largely under British control; many of the sisal plantations in Kenya and Tanganyika are owned by private planters, but some of the largest estates in Tanganyika are owned by British joint stock companies.

Raw Material for Cordage.

Sisal is used chiefly for the manufacture of cordage; its chief competitors are henequen and Manila hemp, both of which have been longer in that commercial field where hard fibres are required. The great harvesting countries are

* Reprinted from The Commercial Textile, Engineering, and Financial Review. November 20,1930. Published by the "Manchester Guardian."

large consumers of cordage, or rather of binder twine. The United States and Canada derive from Mexico far and away the greater part of their supplies of twine or material to make twine, though they also receive a sprinkling of supplies from Java, a fairly important producer, and Cuba.

It is to be regretted that Canada derives hardly any of its binder material from Empire sources; the annual value of its imports from Mexico (in the form of re-exports from the United States) and elsewhere is equal to about £1,750,000. Eighty per cent. of the United Kingdom's supplies of hard fibres come from Manila and New Zealand. So far neither Tanganyika nor Kenya have found difficulty in disposing of their crops of sisal—at least, not until the world-wide commercial depression now prevailing. Belgium is apparently a considerable importer of sisal from these two sources, but it may be assumed that a large quantity of the Belgian imports is in transit to Germany. The growth of the productions of Tanganyika and Kenya in recent years and the acreages under cultivation in Kenya will be seen from the tables following:—

	1913.	1923.	1928.	1930.
Production.	Tons.	Tons.	Tons.	Tons.
Tanganyika ...	21,000	12,845	36,186	*25,863
Kenya ...	211	8,543	16,516	†6,004

* Seven months. † Five months.

Acreage.	1313.	1923.	1929.	1930.
Kenya ...	7,000	39,026	109,385	—

An agricultural census is not taken in Tanganyika, but probably the area devoted to sisal is not less than 150,000 acres. It will be noticed that the production of Tanganyika in 1923 was considerably less than for 1913. This is to be explained by the disorganisation caused by the war and the passing of estates into the hands of fresh owners. Additionally, it must be added that even sisal did not escape the excesses which characterised business conditions in 1920, and extravagant hopes and actions were followed by the inevitable result. It will be seen, however, that the production of sisal in Tanganyika has more than trebled during the last six years, and this is the more notable in view of the fact that the production of Mexican henequen has greatly decreased during the last three years.

Sisal is ordinarily not harvested until the fourth year, but there is no universal practice, and soil and climate cause local variations in the period. Harvesting consists only of the cutting of a portion of the leaves, taking the lower and oldest leaves first; this process is continued for about eight years, when the life of the plant comes to an end. East African sisal leaves are credited with a yield of 3½ per cent. of fibre, or from 60lb. to 80lb. of fibre per 1,000 leaves. The return from Mexican henequen would be approximately 1 per cent. greater than this. If these figures represented the latest achievements, then henequen would have only a small advantage in yield; as a matter of fact, higher yields than 3½ per cent. of dry fibre are common on well-managed East African estates. The latest

returns from three representative East African estates show yields of 4.3 per cent. 4.25 per cent., and 4.69 per cent. Modern fertilising methods have been scarcely applied to the cultivation of sisal in East Africa; there is little doubt that scientific manuring would result in more rapid growth and higher yields.

The British-controlled sisal estates are administered more in accordance with the best modern practice than are the Mexican henequen estates, both with regard to general organisation and the care of labour. Until quite recently the Mexican industry suffered from the handicap that cultivation has been in the hands of a multitude of small owners; efforts have been made to correct this defect by means of co-operative societies, and the Mexican Government has taken steps to bring about the standardisation of the product. East African sisal, however, remains a finer product, partly owing to different methods of cultivation and selection of plants and partly owing to greater efficiency in prepration, scrupulous care being taken to remove all impurities.

The superiority of East African sisal is recognised in the market price, which is normally about 10 per cent. higher than that for henequen. Indeed, a glance at East African sisal shows it to be beautifully clean, and it has an attractive " feel." It is rather surprising that sisal has not yet been used in Great Britain for delicate work, particularly as Mexican peasants have succeeded in producing articles of almost silken appearance from henequen. Probably, sisal will find it way into the textile world eventually; Lancashire, in its search for " fresh woods and pastures new," might do worse than explore the possibilities of this commodity. Incidentally, further development of the East African sisal industry should mean larger exports of piece goods as the purchasing power of the natives increases, so that Manchester might well have more than a casual interest in sisal production.

Commercial Utility Proved.

Some may wonder whether possibly brotex or erbifex, regarding which so much is now heard, may not prove a rival to sisal. All that need be said at the moment on this point is that sisal has proved its commercial utility, and that the other fibres mentioned have yet to do this, though brotex seems to have been used successfully for the manufacture of paper. Sisal also lends itself to the manufacture of paper, and the fibre under the microscope is very similar to the fibre of esparto grass. Tests were carried out last year by an important firm of British paper manufacturers, and samples of paper were manufactured from sisal. The quality of the paper from sisal is not in question, but from a variety of circumstances the manufacture of sisal paper on a large scale is not at present an economic proposition.

The most important probable use for sisal waste is for the manufacture of alcohol. It was mentioned in the report on power alcohol issued during 1927 by the Department of Scientific and Industrial Research that experiments had shown that sisal waste from Kenya was highly favourable for fermentation,

either by itself or with less readily fermentable materials. The less readily fermentable materials might include maize cobs, inasmuch as maize is extensively grown in Kenya.

Important engineering firms have given special attention to the improvement of machinery for the treatment of sisal, including Robeys, of Lincoln, and the German firms of Krupp and Schilde, while many miles of light railways have been built by British specialists for the work of transport. The full benefits of the capital expenditure necessitated by these improvements have yet to be reaped, but on the three estates previously mentioned the c.i.f. cost of production has been reduced during the past four years from £32 per ton to £29 per ton. The price of No. 1 East African sisal was £35 10s. per ton at the end of 1929, against £42 per ton at the end of 1928; the current price is about £22 per ton, which reflects the drastic fall in commodity prices generally.

The provision of power for African sisal estates is still by oil engines, and it need hardly be said that the carrying out of the scheme for providing electrical power from the Great Pangani Falls in Tanganyika (which the British Government has recently sanctioned) will enable the costs of producing sisal in this area to be reduced considerably. Indeed, the provision of electrical power should greatly increase the ability of sisal-growers to compete with their rivals who cultivate similar plants in other lands. Africa has already passed the Dutch East Indies as a producer of hard fibres, and has taken the place of the world's third largest producer, ranking after Manila and Mexico. Probably Manila produces three and a half times and Mexico two and a half times as much hard fibres as Africa, so that, apart from new uses, Africa has plenty of fields to conquer in the matter of sisal supply.

Abstracts.

THE ACTIVE PRINCIPLE OF TUBA ROOT AND METHODS OF EXTRACTION.

Investigations into the best methods of extracting the toxic principle of tuba root have been made in the Laboratory of the Division "Commercial Museum" of the Colonial Institute of the Netherlands at Amsterdam. The results have been published in "Contribution No. 26" which contains a report on the work of that body in 1929. The following is a translation of the portion dealing with this subject.

Our correspondence on the subject of *Derris elliptica* shows that this crop has aroused much interest in the U.S.A. where there is a large demand for insecticides of organic origin which will lose their poisonous properties after some time so that they may be applied to vegetables, fruit, tobacco and such crops for which the use of arsenic compounds is considered undesirable.

For large scale application the organic insecticide should, however, be available in a convenient form of more or less stable consistency and strength and should always be obtainable in sufficiently large quantities at a reasonable price. The maximum price the consumer will be prepared to pay will of course depend greatly on its efficacy, which in its turn depends on the percentage of toxic principles which it contains.

Toxicity of tuba was formerly indicated by the collective name "derrid," an amorphous, yellow, resinous substance obtained by ether extraction. Now that Japanese scientists have separated from tuba a white, crystalline compound which they have called "rotenon" and which has proved to be poisonous, there is a tendency in Japan and in the U.S.A. to presume that this rotenon, so far as extractable and determinable, is the only active agent of derris root. But this is yet far from certain. Attempts to separate crystallized rotenon from the ether extract of Derris root from Sumatra were completely unsuccessful and yet the material was decidedly poisonous. One of the largest German manufacturers of insecticides is also of opinion that rotenon is not the only toxic ingredient of Derris root and may even not be the most poisonous ingredient.*

Chemical and biological investigators must collaborate further before the toxic ingredients have been determined beyond doubt; until then, either the ether extract or the rotenon determination will have to form the basis of judgment and this may lead to differences of appreciation of the same material.

The tests made in this country with Derris root supplied by the Commercial Museum, have confirmed the experience gained in other countries. For flowers

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*As the roots of *Millettia sericea* W & A are used as a fish stunning agent in exactly the same way as derris roots and are considered to be equally efficacious, it might be worth while—(if its toxic agent is still unknown)—to examine the ether extract of Millettia root for content of rotenon or other extractable poisons.—*Translator.*

and fruit in hot-houses Derris emulsion has proved to be an excellent means of killing plant lice; wool lice, however, owing to their natural protective covering, escaped. Flies and fly larvae proved to be immune. At the Veterinary School, dipping of cattle proved to be very effective; ticks especially were completely killed by the emulsion.

The justified demand for a more handy form of the material than the bulky bales of dried roots first led to practical means of reducing the volume and experiments were made in grinding it. A large quantity of roots was ground coarsely, part thereof was ground more finely and part of that still more finely again. Samples of the three powders were sent to the Commercial Museum for examination—(H.M.W. 1266—1.2 & 3).

The moisture content and the toxic principles were determined in the usual way and the averages of analyses in duplicate were found to be:

SAMPLE.	Moisture percentage.	Ether Extract.	
		Percentage of air dried material.	Percentage of dry substance.
I. Ground once. coarse ...	9.1	11.1	12.2
II. " twice. finer ...	8.4	11.7	12.8
III. " thrice. very fine...	8.5	12.05	13.2

The figures in the last column increase steadily and this proves that the finer the material is ground, the more "derrid" is found on analysis. That, however, does not mean that in practice the very finely ground condition of sample No. 3 would be preferable to the more coarsely ground condition of sample No. 1. It might very well be found that sample No. 1 in practice surrenders its toxic ingredients more easily or forms a more efficacious emulsion than the very fine powder of sample No. 3 which may have a tendency to cake. Something similar happens with other materials, for instance, those containing essential oils; that is, the material to be worked must not be too fine.

The three samples of different fineness have been subjected to a series of extraction tests. The first series of tests was made as follows:—

A weighed quantity of each sample with six times its weight of water was shaken in a shaking apparatus for 1½ hours (The Deli Experiment Station grinds the same proportion of root and water for ½ hour in a mill). After shaking, the "porridge" was filtered through muslin, squeezed and then pressed. The still moist powder was then rubbed loose again and dried in a desiccator for two days, after which its toxic content—which for brevity's sake will be called "derrid"—was determined. Deduction of this figure from the already known derrid percentage of the original root powder gives the percentage extracted by the water.

Sample I. 20 grams of powder. Derrid percentage 11.1. After extraction with

water and drying of the residue 17.1 grams of powder was left, the derrid percentage of which was 5.72. Thus, nearly 56 per cent. was extracted.

Sample II. 15 grams of powder. Derrid percentage 11.7. Dry residue 13.9 grams of powder with 5.5 per cent. of derrid. This also amounts to 56 per cent. of extraction.

Sample III. 15 grams of powder. Derrid percentage 12.05. Dry residue 12.58 grams of powder with 6.79 per cent. of derrid. This amounts to 52 per cent. of extraction.

This show that the fineness of grinding has not affected the quantity of derrid extracted. Of the toxic ingredients half only was extracted. It may be that the method of the Deli Experiment Station, in which the root is ground between two millstones, is more efficacious than the shaking in a shaking apparatus.

We have for that reason made further tests with samples Nos. 2 and 3. Of sample No. 1 nothing was left.

The powder was rubbed in a mortar with water, spread on muslin folded four times, and then squeezed out. The treatment was repeated four times with further additions of water. More water had to be used than in the first series of tests as otherwise the powder would not have been wet enough to be squeezed out. Finally, the residue was tightly squeezed and dried and its derrid percentage determined as in the first series of tests.

Sample II. 20 grams of powder. Derrid percentage 11.7. Rubbed 5 times with 50 c.c. of water. Dry residue 17.1 grams of powder with 2.3 per cent. of derrid. This works out at 80 per cent. extraction.

Sample III. 20 grams of powder. Derrid percentage 12.05. Rubbed 5 times with 50 c.c. of water. Dry residue 17.1 grams of powder with 2.3 per cent. of derrid. This works out at 82 per cent. extraction.

Here too the fineness of grinding does not affect the quantity of derrid extracted; but the rubbing method extracted a far greater percentage than the shaking method.

Grinding the root in the country of origin and shipping the powder in pressed bales may meet the requirements of the wholesale trade; the retail trade and the consumer will, however, want it in a more quickly applicable form.

In Deli, Sumatra, a concentrated emulsion that only needs dilution before use is made from the roots. This concentrated emulsion keeps better than might be expected, but eventually its strength deteriorates.

In Japan a preparation is made by dissolving the active ingredients of derris roots in a certain oil; the process has been patented. Derris in this form is said to be very efficient; scientific reports of results obtained are, however, still lacking.

THE DEVELOPMENT OF IMPROVED LIVE STOCK IN THE TROPICS.*

Progress towards the improvement of live stock in tropical countries has been slow. Too great a reliance has been placed on stock imported from temperate countries. The importation of stock into the Philippines from temperate climates has met with meagre success. When the breeds are from tropical countries such as India and China they have proved more successful.

For many years poultry of many of the well-known breeds were imported from the United States of America and Australia. None of these breeds were able to adapt themselves to the Philppine conditions.

In 1914 native yellow fowls were imported from Canton. These chickens were very small and they laid only a few small eggs. A definite body type, however, was noticed. Possibilities in these chickens were very apparent; they allowed themselves to be confined, they were hardy and they were adapted to local conditions, tending to improve under conditions where the other imported chickens degenerated. Years of strict selection and culling, combined with careful mating, good housing and excellent feeding have produced a strain now styled the "Los Banos Improved Cantonese" chickens. They are larger than the original Cantonese. The colour of feather is uniformly rich golden buff, with yellow skin. The eggs are light brown in colour, fairly large in size and satisfactory in number, being about 120 a year. The highest number recorded was from one bird that laid 237 eggs in 365 days.

The experience with other live stock has been similar to that of poultry. The Philippine Government has repeatedly imported improved breeds of horses, dairy cattle, beef cattle and swine from the temperate countries, but they have been unsuccessful; whereas animals imported from India, such as buffaloes and Nellore cattle have done very well. Goats and sheep introduced from India appear perfectly at home in the Islands, unlike these that have been imported from temperate countries which did not do well; even their grades with the native stock failed. A Philippine authority has summed up the position in the following words:—"the ultimate solution of the live stock problems of the Philippines will depend in large measure on the development of superior breeds particularly adapted to the country through gametic methods borrowing physical merits from the breeds of temperate countries and judicially forming mosaics with the hardy characteristics existing in Oriental animals."

Studies towards the improvement of Philippine swine furnish an excellent illustration of the use of temperate animals to develop a tropical breed. Of imported breeds, only the Berkshire and Duroc Jersey did fairly well in the Philippines. Grading with the Duroc Jersey was a failure, while grading with

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* Abstract of an article by F. M. Fronda, Assistant Professor of Poultry Husbandry, University of the Philippines and published in *Lingnan Science Journal*, Vol. 9, No. 3, October, 1930.

the Berkshire, though accompanied by great difficulties because of death caused by kidney worms especially, low vitality and low fertility, has left enough individuals that have stood all the tests of the environment.

A large strain of native swine, known as the Jala-jala was used to impart resistance to disease. With the Berkshire-Jala-jala mating, the foundation of the Berk-Jala swine was formed. In this work it was observed that the greater the proportions of Berkshire blood in the progeny beyond $\frac{5}{8}$, the less satisfactory the results. Pigs carrying $\frac{5}{8}$ Berkshire blood gave the best results and at the same time were of the right proportions.

Investigations with cattle have given similar results. Hereford cattle were imported. The progeny of these animals were very delicate and a large proportion of them died young. Those that survived grew very well for the first few months, then became stationary in weight.

However, 50 per cent. grades with either native or Indian cows are found to grow normally and are almost as hardy as the dams, although they do not stand neglect as well as native cattle. Three-quarter grades are very delicate, being almost like pure breeds in this characteristic. The results of later matings show fairly conclusively that if efforts are made to fix a definite breed from the Hereford native cattle, the progeny carrying about $\frac{1}{2}$ Hereford blood will have to be utilised.

There is little data regarding horse breeding. The Arabian, on the whole, has been the most successful imported breed. Grade Arabian-Filipino horses may now be found in certain regions and quite a number are being used on the race tracks in Manila. What proportion of the Arabian blood with the native horse will produce the best results is still an open question.

Regarding dairy cattle, the Philippine experience has been that imported stock deteriorate rapidly so that new importations are constantly required to maintain the milk supply.

Experiments with goats proved similar to those with cattle, a 50 per cent. mixture giving the best results.

The conclusion is drawn that "with China's rich supply of unimproved domestic animals and with her many and varied conditions favourable for their development, the possibilities of live stock improvement in this country (China) are great. The proximity of the Philippines to this country, the similarity of environmental conditions in both places and the common qualities of our native domestic animals are an insurance that what experience we have had in the improvement of live stock may be profitably used as a guide for similar undertakings in this country."

RUBBER ROADWAYS.*

The failure of the first experiments in rubber paving was due to the fact that the blocks "crept," the traffic pushing them in the direction of travel, the joints between the blocks were broken allowing water to get to the foundations.

Progress since these early experiments has been both rapid and definite. Demonstration sections have been laid which have successfully withstood the strain in streets where the heaviest and most varied modern traffic can be found; no movement has been observed, and no joint has been broken after several years.

Furthermore, rubber paving can be produced and laid at a price which makes it possible for the road engineer to lay it in streets and areas where silence and absence of vibration justify the higher (but not materially higher) initial cost.

Rubber paving obviates the two great evils of modern traffic, noise and vibration. No other material possesses these remarkable properties. Further, a rubber road makes no dust and is not slippery.

Although he can now obtain rubber paving at a reasonable price, the city engineer cannot state yet what will be the ultimate life of a good and sound rubber block. This difficulty is being overcome by an adequate free maintenance guarantee by the contractor.

A scheme put up by the Rubber Growers' Association Council to their members and to Dutch and Asiatic producers, provides for a supply of free rubber to approved manufacturers of rubber paving to facilitate research and to assist during the period of commercial introduction; but more important still, it would guarantee manufacturers and municipal bodies for a period of five years against a substantial rise in the price of the raw material. The approved manufacturers would be guaranteed supplies of raw rubber up to a certain percentage of the crop of the Rubber Growers' Association members and of other producers who come in, at 6d. per pound or market price, whichever is the lower, and a further percentage at 9d. per pound or market price, whichever is the lower. This would enable the manufacturer to maintain his price at a low figure irrespective of fluctuations in price of raw rubber.

The writer concludes that the scheme would be of permanent assistance to the rubber industry and that the manufacturers would not be allowed to suffer should the price of the raw material at the end of five years be such as to make further arrangements with the producers necessary.

Municipalities which embark on a definite programme of rubber paving to be carried out over a period of several years could therefore rely on prices not going up in the midst of the execution of their programme.

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* Abstracted from "Noiseless, Dustless Highways," published in *The Commercial* of November 27th, 1930.

Reviews.

The Soya Bean and the New Soya Flour.

BY

C. J. FERREE,

William Heineman (Medical Books) Ltd., London, 1929.

This translation forms a useful and concise compilation of information regarding trade statistics and the food value of the soya bean.

This bean can be grown easily under a very wide range of conditions, forms a profitable rotation crop with maize, wheat and other cereals, and its cost of production is comparatively low in countries where it is grown on a large scale. Production has been greatly stimulated, chiefly in Manchuria, during the past few years, without however affecting the price of the product materially, though its extended use has been a factor in depressing the price of other oil producing products (copra, etc.)

The high *food value* of the soya bean is stressed and confirmed by chemical and medical opinion, and the extended use of the bean in a European diet is advocated, especially in the form of flour as an admixture with wheaten flour in the staple diet. The strong flavour of the boiled beans is not palatable to most Europeans, but, used as flour and mixed with other foods in varying proportions (numerous recipes are given), the taste is counter-balanced and the food ration is rendered more nutritious.

The book extols the use of the Berezeller's soya flour, but unfortunately, does not mention its price or where it is obtainable, and it does not appear to be known by local chemists or grocers.

H. W. J.

Elucidative Notes on the "Kapok Decree." *

BY

DR. W. L. UTERMARK,

Pamphlet No. 53 of the Division Commercial Museum of the Royal Society Colonial Institute of the Netherlands at Amsterdam.

In this pamphlet the author gives the history and object of a recent Decree of the Government of the Netherlands by which the sale of any adulterated kapok or of any article in the manufacture of which adulterated kapok has been used, is made a heavily punishable offence unless duly and properly marked as having been adulterated with other fibres and to what extent.

As " kapok " the Decree defines :

" the fibre taken from the inside of the fruit of *Ceiba pentandra* Gaertner

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* Het Kapokbesluit Toegelicht.

and of species of the genus Bombax and not containing more than traces of impurities."

The Decree owes its enactment to a petition, presented to the Ministry of Labour, Industry and Commerce by the Association of Wholesale Kapok Merchants and the Association of Dutch Kapok Manufacturers with the collaboration of the Commercial Museum.

The object of the Decree is to put a stop to the abusive practice of selling in retail, as genuine kapok, for the sake of cheapness, articles filled with adulterated kapok or the adulterated filling material itself for the home-manufacture of such articles.

Adulteration, however slight, is all the more reprehensible because even a small admixture of foreign material reduces the efficacy of the kapok itself out of all proportion to the percentage of the admixture.

The Netherlands rank as the greatest per capita consumer of kapok and the interests of the manufacturers of bedding, life-saving apparatus, etc. demanded protection from the danger involved in loss of public confidence in the quality and efficiacy of their own products as a result of the inevitable dissatisfaction that the use of cheap substitutes, manufactured by irresponsible persons and sold under the name of the genuine article, is bound to engender. It was feared that otherwise in the long run the genuine article itself would become generally discredited with detrimental effect on the demand.

Java kapok is of a superior quality and Java supplies to the Netherlands about 70 per cent. of the total yearly import of about 5400 tons. Java's total export in 1928 and 1929 was respectively 18,360 and 17,667 tons of a value of respectively about £1,625,000 and £1,560,000. It was, therefore, considered all the more necessary to protect the fair name of the Java kapok.

The most common adulterations are cotton, plant silk, Bombay "akund" and waste of artificial silk. The latter three are easily detected under the microscope: cotton less easily. In preparations with water or a mixture of water and glycerine admixture of a weakly acid per cent. solution of anilinsulphate will, however, stain the kapok fibre yellow whereas the cotton fibre remains unaffected. Fuchsin solution (1 gram to 6000 c.c. of 50 per cent. alcohol) stains the kapok fibre a bright red—less bright when unripe—whereas the cotton fibre is very little affected. A further means of detection of admixture of foreign material is the pentosan determination, directions for which are given. Pure kapok, dried at 102°—105°C, contains at least 25 per cent. pentosan whereas cotton contains 3 per cent. only. Bombay "akund" has so high a pentosan percentage that a mixture of kapok, cotton and akund in the proper proportions will give the normal pentosan percentage of pure kapok. But akund, as stated before, is easily detected under the miscroscope and its presence is even visible to the unaided trained eye.

That the legislator means business is proved by the fact that the penalty for offences against this Decree is imprisonment of up to six months or a fine of up to Grs. 2000—(£166.13.4)—and confiscation of the merchandise involved.

The pamphlet further contains a reprint of an earlier pamphlet, giving

botanical and economic particulars, directions for curing and packing and an enumeration of the properties and uses of kapok.

L. A. J. R.

Report on the Cultivation, Treatment and Prospects of Rice in British Guiana.

BY

CHARLES E. DOUGLAS, M.I.Mech.E., A.M.I.Pet.T., M.I.Struct.E.

Issued by the Empire Marketing Board, August, 1930.
Printed and Published by His Majesty's Stationery Office, London.
Price 1s. 0d. Net.

The author opens by a general description of rice growing conditions pointing out that the country is admirably suited for rice since the cultivated lands are flat, the soil is good (mostly old sugar land) and there is an abundant water supply.

The rice is grown either on sugar estates by and for the coolies employed thereon or by small farmers for profit, or by large estates as the main crop, or in conjunction with bananas or coconuts, chiefly for export.

It is of interest to note that the fields are ploughed by oxen and are mainly planted with seedlings which are only 4 weeks old whereas in Malaya the optimum age of seedlings is usually taken as 6 weeks. On large plantations, cultivation and irrigation are carefully tended whereas small tenant farms show much neglect in these particulars and need some form of supervision.

The area cultivated in 1929 was 59,000 acres which produced 71,000 tons of padi or 42,600 tons of rice of which 14,000 tons were exported as parboiled rice. The author mentions that the market for this type of rice is restricted to areas where East Indian labour is found and that the demand for such rice is easily met from the cheaper Eastern markets and, therefore, infers that British Guiana parboiled rice can only enjoy a very limited market.

On the other hand, there is an immense market for white rice of good quality and the Colony should aim at the capture of a large share of this trade in neighbouring countries.

In most of the rice lands mechanical cultivation is hardly possible under existing conditions, because of the smallness of the fields, but this defect can be remedied and there is ample evidence that mechanical methods are practicable in the Colony if due consideration is given to the type and weight of the machinery used, the time and circumstances of their use and adequate cleaning and housing after use, although the question of capital cost will debar many tenant farmers from progress in this direction.

As far as marketing of British Guiana rice is concerned, there has been practically no organisation so that the product is sold in small quantities of varying quality indifferently bagged and therefore is not held in good repute by the large traders.

The adoption and enforcement of uniform standards in quality, bagging, shipping and selling should help materially in establishing the reputation of the product especially if such measures are combined with agricultural research directed at the improvement of grain types towards securing the local markets and of methods of cultivation and milling.

Several illustrations and diagrams are included, the most useful being those of types of small mills and the tables of costs of production of rice in the Colony. The latter are informative and compare closely with those in Malaya if the Straits Dollar is substituted for the American.

H. W. J.

The Bionomics and Control of *Leptocorisa acuta* Thunb. with Notes on Other Leptocorisa spp. in Malaya.

BY

G. H. CORBETT, B. Sc.

Special Bulletin, Scientific Series No. 4 Department of Agriculture, S.S. and F.M.S. 39 pp. 7 plates: price $1 (Straits Settlements currency) F.M.S. Government Printing Office, Kuala Lumpur, 1930.

On the five species of the genus *Leptocorisa* occurring in Malaya *Leptocorisa acuta* Thunb, is considered to be the most series pest of padi in certain districts In some cases, the yield of padi has been reduced by 30 per cent. of the normal by reason of its attacks.

These bugs occasion damage by sucking the sap from the developing grain in consequence of which no grain is formed.

The insects attack grasses as well as padi, a fact which enables them to tide over the period when no padi is on the fields. Furthermore, in a normal year a resting period would appear to occur during the drier months, at the termination of which the insects swarm to grasses and then to the first flowering padi.

Part II and III of this Bulletin deal with the systematic and biological work on Malayan species of *Leptocorisa,* while Part IV is concerned with methods for the control of the pest. These methods of control may be summed up as follows :—(a) Uniform planting throughout large areas, (b) systematic trapping to small areas of grasses or early maturing padi and (c) collection of the pest on padi by means of "wands." The result of the practical application of the methods is described. The author urges that " without active organised campaign this insect will continue to cause heavy losses, but if they are undertaken control is assured, with the result that yields of padi will not be greatly reduced through the agency of this insect."

D. H. G.

DISTRIBUTION OF *OIDIUM HEVEAE* DISEASE OF RUBBER IN MALACCA AND SOUTHERN NEGRI SEMBILAN, NOVEMBER, 1930.

BY

F. BEELEY, B.SC. (LEEDS.)

Field Officer, Rubber Research Institute of Malaya.

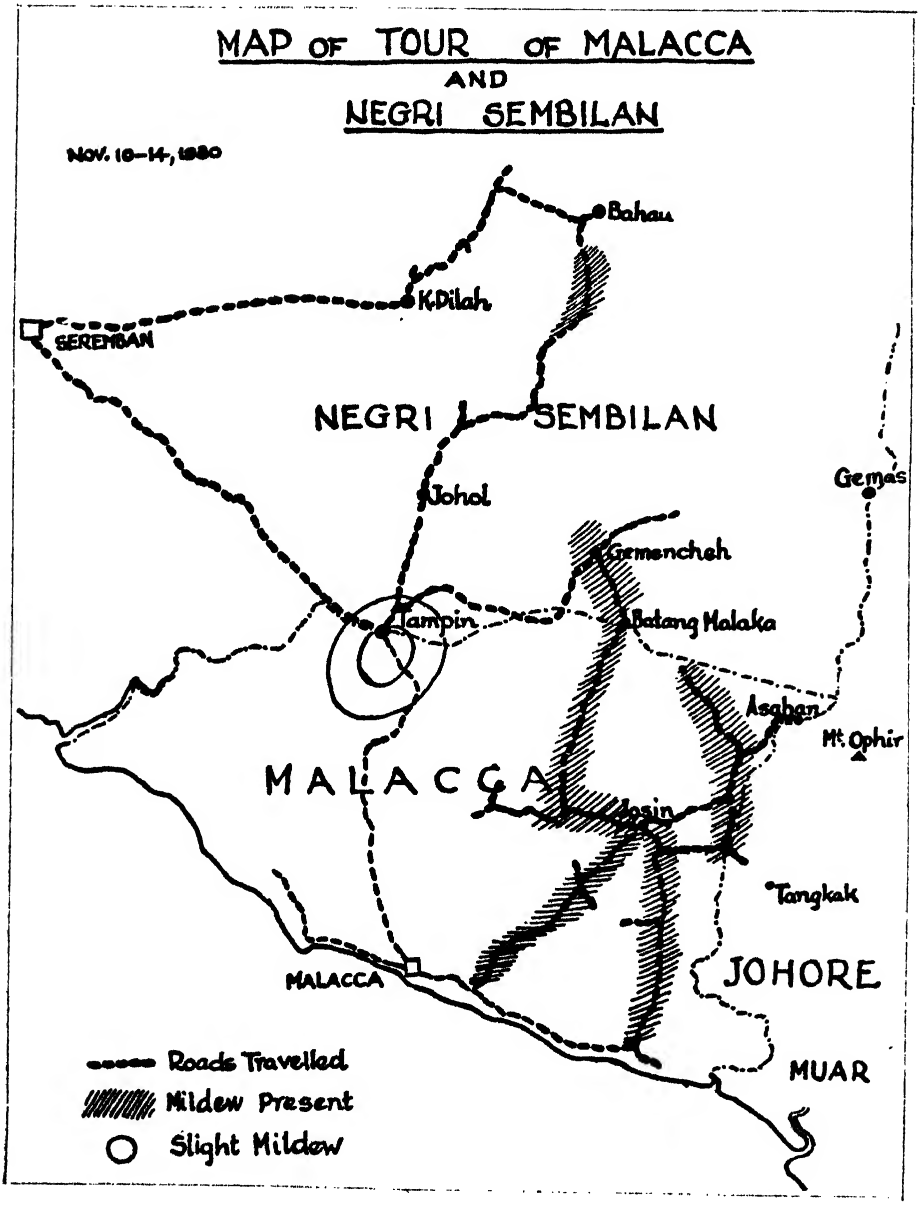
From Kuala Lumpur the direct route to Malacca via Seremban and Tampin was taken. From Malacca various radial roads were taken with the particular object of examining estates and small holdings in the South Eastern half of Malacca Territory. The return journey was via Batang Malaka, Tampin, Bahau, Kuala Pilah and Seremban.

To determine the presence or absence of the disease, young leaves and flowers developed on new shoots produced during recent wet weather were examined with a hand lens, and of specimens showing the presence of the fungus a few were preserved in Piero Formal solution and brought back to the laboratory for confirmation by microscopical examination. These latter in each case amply confirmed notes made on the spot. It was again noted that mature leaves showed no signs of the living fungus, though many leaves shewed the effects of an attack by the fungus during their early stages of growth. The active fungus could usually be found on young leaves up to 2 or 3 inches in length, and the underside of such leaves showed grey furry patches of fungus when viewed from a very oblique angle.

Districts of known infection—

District.	*Service Road.*
Ayer Panas and Ayer Molek ...	Malacca-Jasin.
Jasin and Merlimau	Jasin-Merlimau.
Chin Chin	Jasin-Tangkak.
Rim, Nyalas and Chalau ...	Jasin-Bukit Asahan.
Kesang, Selander and Batang Malaka	Jasin-Batang Malaka.
Tampin—slight infection only ...	
Gemencheh	Batang Malaka-Gemencheh.
Jeram Padang	Tampin-Bahau.

The "Johol" district of Negri Sembilan, from which reports of the presence of the disease were received earlier in the year, appeared to have made a complete recovery from the disease. Similarly, the younger rubber in the Gadek, Pegoh and Tampin districts had made good recovery, while the older rubber over 15 years still showed effects of the disease, though presence of the fungus could not be demonstrated during the visit.


MAP OF TOUR OF MALACCA
AND
NEGRI SEMBILAN
Bahau
K. Pilah
SEREMBAN
NEGRI SEMBILAN
Johol
Gemas
Gemencheh
Tampin
Batang Malaka
Asahan
Mt. Ophir
MALACCA
Jasin
Tangkak
JOHORE
MALACCA
MUAR
Roads Travelled
Mildew Present
Slight Mildew

The active sporulating fungus could be found only on the young leaves and flowers produced during the recent growing weather. In some cases the fungus was having very little effect on the leaves, but in others, more especially on older rubber trees, the young leaves were beginning to discolour preparatory to falling off. No extensive leaf fall was actually taking place, save on a few occasional branches of trees which has wintered prematurely. The younger rubber trees seemed to be least affected and to have made the best recovery from the April attack.

Trees under 3 years old failed to show the presence of the fungus and the mature leaves failed to show possible effects of an attack by the Mildew fungus. The foliage of 2 and 3 years old clearings, even though surrounded by known affected fields of older rubber, bore an excellent crown of foliage.

Trees over 15 years seemed to carry the heaviest infection of the fungus at the present time, while the recovery from the April attack was very poor. The foliage in such fields of old rubber was in most districts very light, consisting of pale, mottled green wrinkled and often undersized leaves.

Very few maturing seeds were observed, indicating that flowers must have been infected practically throughout the year.

From these observations it would appear that the greatest necessity for treatment obtains in areas of rubber over about 15 years old.

Young leaves in such areas were observed to be heavily infected and should dry weather occur during the next wintering and re-foliation period, a heavy fall of young leaves during re-foliation may be expected.

The Director, Rubber Research Institute of Malaya, in a letter which accompanied this report stated—

> " As will be seen from this report, the fungus has persisted in some areas since the original heavy attack earlier this year " (1930.)
>
> " It is proposed early next year, shortly before the wintering season, to carry out preventive spraying on a considerable area, in order to ascertain whether such measures are likely to prove effective. This can, of course, only be proved definitely if an outbreak happens to occur after the wintering season. I consider, however, that such work is essential. An Agency firm has been good enough to place at our disposal suitable areas in the affected districts."

Mr. Bjorklund, the inventor of the Duster of that name for the treatment of Oidium disease has recently arrived in Malaya. He will be pleased to arrange for demonstrations of his Duster as time permits. Applications for demonstrations should be addressed to his Agents, Messrs. Diethelm & Co., Ltd., Singapore.

THE AGRICULTURAL ADVISORY COMMITTEE.

The Agricultural Advisory Committee met at the Department of Agriculture, Kuala Lumpur, on January 15th, 1931, under the Chairmanship of the Director of Agriculture, Dr. H. A. Tempany. The following are among the more important subjects considered by the Committee.

Extension of Work to the Unfederated Malay States. Progress has been made in this direction. Two European Officers have been seconded, one to the service of Kedah and the other to Kelantan. It is hoped, in due course, to extend the agricultural services to the other Unfederated Malay States.

Seed Distribution in Krian. Distribution of pedigree seed in the padi growing district of Krian has proved moderately successful during the past season. Although less seed was sold than was anticipated, nevertheless, 5451 gantangs of seed were disposed of at a loss to Government of $405. Members of the local co-operative societies were amongst the best patrons for this seed. Next year it is hoped to extend distribution of seed in Malacca from pure lines grown at the Pulau Gadong Station, Malacca.

It was suggested that organised visits of Co-operative Societies to the Rice Experiment Station, Pulau Gadong, Malacca, will be the only effective method of insuring distribution of pedigree seed. It has also been suggested that visits of local headmen from the State of Pahang to Malacca and Negri Sembilan instead of Krian where the conditions are highly specialised would prove useful in this connection.

Parasite Control Work. The Chairman stated that the work of the Entomological Division on parasite control is one of the most important items on the programme of the Department. It has been found that stem borer damage to padi in Krian is greater than was anticipated. The work will be repeated next year when an endeavour will be made to ascertain the number of parasites necessary for the control of large areas and the probable cost of extending the work throughout Malaya. An officer will be sent to Kedah to ascertain whether the stem borer pest is as serious there as it is in Krian.

Standard Manurial Experiments. Modern work has resulted in certain definite requirements being laid down which all manurial experiments must fulfill. A Committee controls and co-ordinates the work of this nature in the Department of Agriculture. This Committee has laid down standard manurial experiments on padi which are at present being conducted at the Pulau Gadong, Talang and Titi Serong experimental stations.

Coconuts. In the course of several items on the coconut industry which were discussed by the Committee, the Chairman stated that the possibility of erecting standards for copra, especially among small-holders is being considered by a small Committee as also is Government inspection and grading, such as is practised in West Africa and certain other countries. It is admitted that there is at present no incentive for small-holders to improve their copra, but this needs further investigation.

Film Propaganda. The Chairman reported that the Propaganda Van has been completed and has made a few preliminary trials. The first lecture tour will start on 19th. January. The trailer is not yet completed. When completed, exhibits of specimens will be placed on the trailer.

A film is in course of preparation by the Department which is designed to drive home the importance of extending the cultivation of padi and also of using pedigree seed.

Palm Kernel Oil. Attention was drawn to the report on the low quality of Malayan palm oil. Following suggestions made by Major Eaton, an enquiry was addressed to Sumatra from which it transpired that Sumatran palm oil is sold at lower prices than that from West Africa. This is attributed to factory methods employed in extracting the kernel. Further comparisons of African and Malayan kernels will be made.

The question of rat damage on oil palm estates was discussed. It is stated that such damage is increasing. The Department has recently been in correspondence with the Pasteur Institute in Paris with regard to their latest virus, but the replies received were unsatisfactory.

It is considered that control of rats is a matter for an organised simultaneous campaign of estates. The Department cannot undertake such a campaign, but officers could be detailed to assist and advise.

Work at Cameron's Highlands. Government has definitely decided that the Department shall retain the Tanah Rata experimental station.

Mr. Curtler, Assistant Agriculturist, is to be stationed at Cameron's Highlands not only to look after the Experimental Station, but also to give advice to the planting community on general agricultural questions and to Government on the question of alienation of land.

Establishment of a Dairy at Fraser's Hill. Arrangements for the establishment of such a dairy are well advanced. Mr. Ritchings, Horticultural Assistant, will shortly be stationed on the Hill and it is proposed to establish a farm in connection with the dairy from which it is hoped eventually to supply fresh vegetables to other parts of Malaya.

School of Agriculture, Malaya. The buildings are practically completed and furniture is in process of installation. There are at present about 30 applications for the three year's course and 400 for the short course. The total accommodation is 80.

School Gardens. The representative of the Education Department expressed appreciation of the work of the Department of Agriculture in connection with school garden work. It is agreed that consideration should be given to a "Gardens Week," that is, a competition for village gardens. It was agreed that the teaching of gardening in elementary schools is essential if a true agricultural sense is to be developed in Malaya.

Departmental.

FROM THE DISTRICTS.

The Weather.

In the northern Districts of Kedah dry weather was experienced throughout the month, but in most parts of the Peninsula heavy rain in the first half of the month was succeeded by fine dry weather towards its close. In parts of Pahang there were severe floods, notably at Temerloh and Pekan where the water did not subside until about two weeks had elapsd.

Remark on Crops.

Rubber.—The local prices given for rubber from small holdings weakened slightly, smoked sheet selling for $12 to $17 a picul and unsmoked sheet for $9 to $14 a picul.

Wintering had commenced in Seremban and Port Dickson Districts of the Negri Sembilan by the end of the month. In Pahang West wet weather and the continued low price combined to cause a further increase in the number of untapped holdings.

Mouldy Rot disease remained in evidence and required continuous careful attention, notably in parts of Perak South and Selangor where special measures have been found necessary to ensure its effective control.

Padi.—Reaping was in progress throughout the country, except in Perak North where the crop has not yet ripened. In most of the padi areas along the Pahang river a satisfactory crop was reaped before the floods commenced, except in the parts of Pekan District nearer the mouth of the river where it is feared that most of the padi was destroyed.

In general, yields are expected to be quite up to the average, while the crops in Kedah and Province Wellesley are reported to be distinctly good. Unfortunately, the price remained very low owing to the effect of big crops and low prices in Burma and other rice exporting countries.

An endeavour is being made in Kedah to carry out a scheme for checking estimated yields by cutting and measuring the crops from a number of small plots, each 1/45 acre, taken at random. The results are being compared with the estimates of the crop supplied by the growers themselves. So far the figures obtained by the two methods have been found to agree fairly closely.

Sogata furcifera (pallescens) caused but little further damage to padi in Krian District. In the Central District of Malacca counts of the number of padi stems attacked by the various stem borers indicated that these pests must be causing considerable loss, since the records available up to the end of the month showed that slightly more than 50 per cent. of the stems were bored.

Coconuts.—In some of the inland Districts, especially in the Negri Sembilan and Selangor, the price of nuts has risen by one or two cents each in response to

the extra demand from Malays during the fasting month. In the Negri Sembilan, there has also been a rise in the price of other products consumed by Malays during this period, as for example cooking bananas, locally made palm sugar and fish.

Outbreaks of the nettle caterpillar *(Setora nitens)* were recorded on two estates in Perak South. Another outbreak near Alor Star in Kedah was quickly controlled by a Tachinid parasite.

Fruit.—There was a good crop of fruit in Perak South particularly of durians and rambutans. In Selangor the crop was fair except in the Districts of Ulu Langat and Kuala Langat where it was below average. Durian, mangosteen, rambutan, pulasan and langsat were available in the markets. In the Negri Semblian there was a fair crop of durian, langsat and mangosteen, but the crop of other fruits such as rambutan, chiku and rambai was small. In Pahang West all these fruits were harvested in fair quantity.

Food Crops.—In Pahang West the recent flooding of the Pahang river and its main tributaries resulted in the inundation of considerable areas planted with food crops such as maize and tapioca. The crops are said to have been lost in many cases, but details of the extent of the damage are not yet available.

Coffee.—Good crops were reported to have been obtained in Selangor, but the market price remained low, being 12—20 cents a kati for beans in Selangor and \$20—\$22 a picul in Pahang West.

The Agricultural Field Officer, Negri Sembilan, gives the following instance of the success of measures for the control of the Coffee Berry Borer *(Cryphallus hampei)*. In 1930 a property in Kuala Pilah District was found to be badly infested and in accordance with departmental recommendations the trees were stripped of all fruit. On inspection of the area during January not a single infected berry was found though most of the trees were in bearing again and had a good crop of ripe fruit.

The incidence of this borer has decreased in most coffee properties in Pahang West.

Tobacco.—Certain Chinese market-gardeners in Province Wellesley have been growing tobacco for sale in Penang where it is made up into cheap cheroots. The price now offered, \$25 per picul of leaf, is so low that the gardeners have decided temporarily to cease growing this crop.

The manager of an estate in Province Wellesley has become interested in tobacco cultivation and is preparing to plant a trial plot of 1 acre.

Notes on Demonstration Stations and Padi Test Plots.

Telok Chengai Padi Experiment Station, Kedah.—The growth of the padi was satisfactory. Work performed consisted mainly of daily examination of the plots for plants not true to type and of preparations for harvesting the early maturing varieties. Damage by stem borers (principally *Diatraea auricilea* and *Sesamia inferens)* was very noticeable in some of the plots.

Kuala Kangsar Agricultural Station.—The cover crop established in Decem-

ber made good growth. Preparations were made for replanting the vegetable area. Yams were harvested.

Kuang and Kajang Padi Test Plots, Selangor.—Harvesting was in progress throughout the month, being protracted owing to uneven ripening and wet weather. Much grain was lost through lodging and the depredations of sparrows. Allowing for the difficulties experienced a fair harvest should be obtained at Kuang, but at Kajang the crop as a whole is not expected to be satisfactory, though some of the more favourably situated plots looked promising.

Dong Padi Test Plot, Pahang.—Harvesting commenced on January 1st. in bad weather. Heavy rains during the ripening period are expected to result in a comparatively high percentage of empty ears and only a moderate crop is anticipated.

Temerloh Padi Test Plot, Pahang.—This plot was inundated for twelve days and the crop was destroyed, so that no results will be obtainable.

Pulau Gadong Padi Experiment Station, Malacca.—Harvesting was in progress throughout the month. A demonstration was given to over one hundred Malays who displayed considerable interest in some of the selected strains of local padi and most of whom took away bunches of ears for seed purposes.

Sungei Udang Agricultural Station, Malacca.—Good progress was made in clearing the land. The earth work of the entrance road was completed and the sites for the buildings were levelled.

Plants Distributed.

In Pahang West planting material of tapioca, sorghum, groundnut, soya bean, and *Crotalaria usaramoensis* was distributed to school gardens. Distributions from the Seremban Fruit Nursery included seedlings of rambutan and annatto and cuttings of carpet grass, while marcots of rambutan and lime were obtained and distributed by the Agricultural Field Officer, Province Wellesley.

Weekly Markets.

Weekly local markets in Kuala Pilah District of Negri Sembilan still continue to attract a large number of pepole. It was noticeable that the vegetable and fruit were mostly disposed of very quickly. The price of poultry in these markets is stated to be usually less than half that in the Kuala Pilah market, while the prices of vegetables in the latter market have been reduced.

Rat Destruction.

In Province Wellesley 103,470 rat tails were collected during the month and 45,512 poisoned baits were distributed. In Krian 2,366 rats were destroyed, and very large quantities of poisoned baits were given out, since it was found that a certain amount of damage was being occasioned, in spite of the large number of rats killed during 1930. In Malacca rewards were paid for 21,763 tails and the position in respect of rat damage was satisfactory.

DEPARTMENTAL NOTES.

Visit of His Excellency to Serdang.

His Excellency the Officer Administering Government and High Commissioner of the Malay States, Mr. John Scott, C.M.G., visited the Government Experimental Plantation, Serdang, on 1st. December, 1930.

Appointments.

Mr. G. E. Mann, M.C., M.A., Agricultural Instructor (Malay Officers), Department of Agriculture, S.S. & F.M.S., has been appointed Vice-Principal of the School of Agriculture, Malaya.

Mr. V. Dawson, B.SC., (McGill) has been appointed a Senior Lecturer, School of Agriculture, Malaya from 11th. December, 1930. Mr. Dawson assumed duty on his arrival in Malaya on 8th. January, 1931.

Mr. A. J. Simpson, B.SC., (Agric) has been appointed an Agricultural Field Officer, Department of Agriculture, S.S. & F.M.S. from 1st. January, 1931. Mr. Simpson will be stationed at Taiping for a short period of training in his duties. He will assume duty as Agricultural Field Officer, Perak South on the departure on leave of Mr. A. E. Curtler.

Mr. H. D. Leighton, C.D.A., has been appointed an Agricultural Field Officer, Department of Agriculture, S.S. & F.M.S. from 11th. December, 1930. He assumed duty on his arrival in Malaya on 8th. January, 1931. Mr. Leighton is stationed at Kuala Kangsar, Perak, as Agricultural Field Officer, Perak Central.

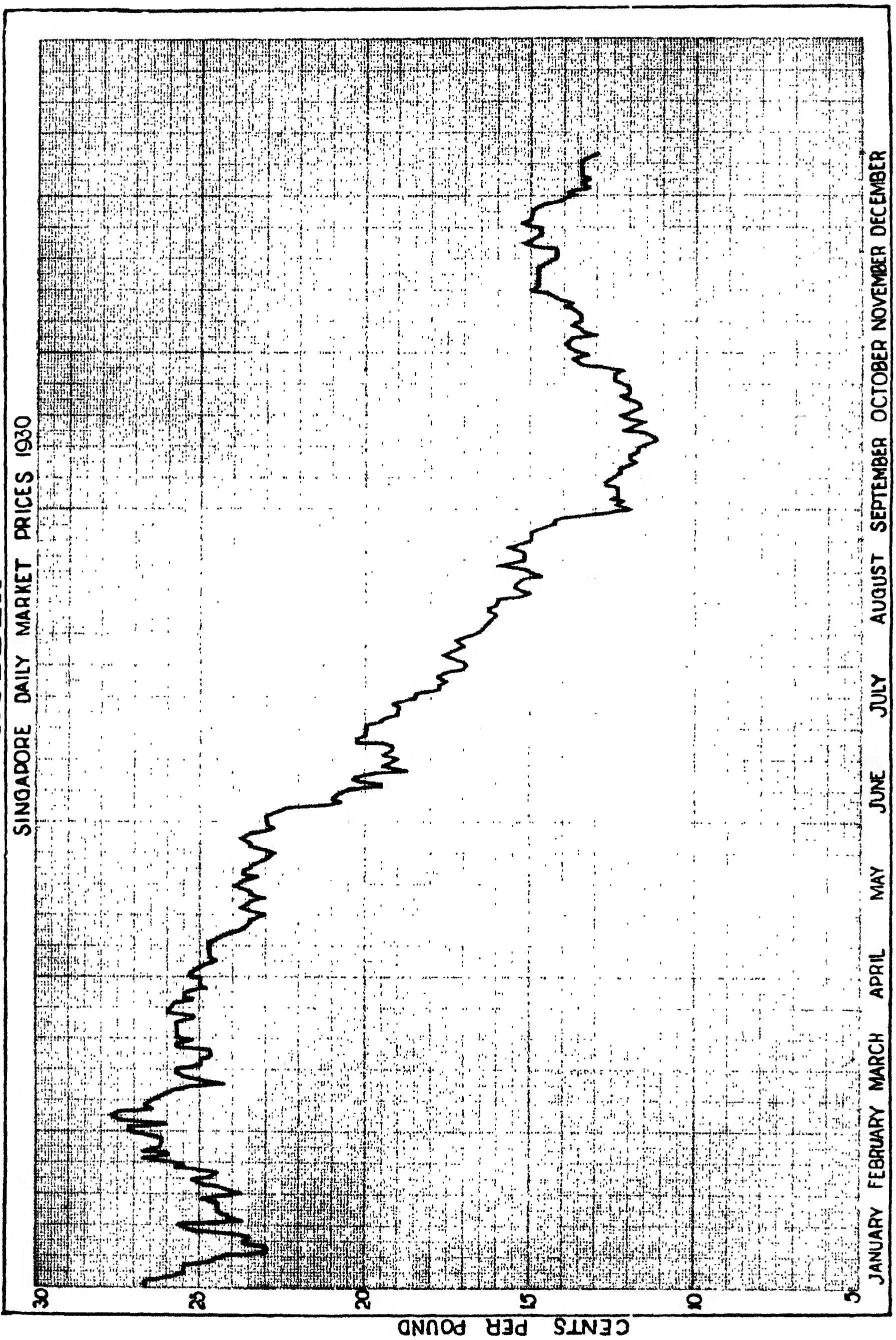
Mr. C. M. Maggs has been appointed an Horticultural Assistant, Department of Agriculture, S.S. & F.M.S. from 26th. December, 1930. Mr. Maggs assumed duty on his arrival in Malaya on 23rd. January, 1931.

Leave.

Mr. A. Thompson, B.SC., Acting Mycologist, has been granted nine months and one day leave on full pay, with effect from the 6th. February, 1931.

Mr. J. M. Howlett, M.C., B.A., Cam. Dip. Agr., Agricultural Field Officer, Pahang East has been granted ten months leave on full pay, with effect from the 6th. February, 1931.

RUBBER


SINGAPORE DAILY MARKET PRICES 1930
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER
30
25
20
15
10
5
CENTS PER POUND

Statistical.

MARKET PRICES.

January, 1931.

Rubber.—The average price of rubber in Singapore was 12.8 cents per lb. against 14.3 cents per lb. in December 1930. The highest price quoted during the month was 13½ cents on 14th. January, the lowest being 11⅝ cents per lb. on 31st. The average London price for the month was 4.1d. against 4.3d. for the previous month. The highest price, 4¼d. was quoted on several dates, the lowest —3 15/16d.—on 31st. January.

Palm Oil.—No cabled quotations were received from London by our correspondent, which indicates that there is little change in the market. The quotations for the latter half of December were £16.10.0 to £16.12.6 f.o.b., basis 18 per cent. f.f.a. Other oils continued to decline, however, which may effect palm oil still further.

Copra.—The Singapore market has remained steady with a good demand. Supplies have been moderate. Average prices in Singapore: Sundried, $5.72; Mixed, $5.41; Cake, $1.75 per picul. The highest price for sundried was $5 :90 on 23rd; the lowest $5.50 on 5th. and 6th. Average prices in December 1930 were: Sundried, $6; Mixed $5.66; Cake, $1.75 per picul.

Pineapples.—Renewed activity in canned pineapples has been evinced during the month. There has been an improved demand and packers have tended to hold for higher prices. The "Winter Pack" is nearly finished and there is now a better consumption demand at slightly higher prices. 1½ lb. cubes advanced twenty cents to $3.60 per case; 1½ lb. sliced flat have advanced to $3.30; while 1½ lb. sliced tall have remained steady at $3.80 per case.

Tapioca.—Flake, fair has declined from $4.50 to $4.10 per picul; pearl, seed from $5.50 to $5.00 and pearl, medium from $6.25 to $6.00. Singapore average prices for January: flake, fair, $4.20; pearl, seed, $5.25; pearl, medium, $6.20 per picul, compared with $4.65; $5.71; $6.50 per picul in December. Prices for flake tapioca tended to harden towards the end of January.

Sago.—The Singapore market has been quiet with a moderate demand. Average prices: pearl, fair, $6.50; flour, Sarawak, $2.70 per picul. Corresponding averages for December were $6.50 and $3.04.

Rice.—Siam rice shewed an upward tendency, from $178 to $192; Saigon No. 1 was fairly steady between $175 and $180; Rangoon No. 1 declined during the first week of the month from $163 to a price around $155. Average prices in Singapore were Siam No. 2, $186, Saigon No. 1, 176, Rangoon No. 1, $156, all per coyan.

Gambier.—Supplies negligible and little business passing. Singapore average prices for January; block, $9.50; cube No. 1, $15 per picul.

Pepper.—Singapore prices sagged during the month, but closed steady on a firmer demand in London. Average prices: Singapore, black, \$20.87; Singapore, white, \$36; Muntok, white, \$37.06 per picul. Average prices for the previous month were \$22.62, \$39, \$40.50 respectively.

Cloves.—Average Singapore prices: Zanzibar, \$62.25; Amboina, \$60.25 per picul.

Nutmegs.—Featureless in Singapore market. Average prices for January; 110's, \$23.88; 80's, \$20 per picul, compared with \$25.37 and \$31.25 per picul in December 1930.

Mace.—Average prices in Singapore; Siouw \$72.75; Amboina, \$52.63 per picul against \$73.50 and \$50 respectively in December.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Market Reports published during January and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore), Ltd.

1 picul = 133⅓ lb; coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

MALAYA RUBBER STATISTICS

STOCKS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORTS AND EXPORTS, AND THE ESTIMATED PRODUCTION OF ESTATES OF LESS THAN 100 ACRES, FOR THE MONTH OF DECEMBER, 1930, IN DRY TONS.

Territory	Stocks at beginning of month			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated)		Imports				Exports (including re-exports)				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1930	during the month	during the year 1930	during the month: Foreign	during the month: From Malay States	during the year 1930: Foreign	during the year 1930: From Malay States	during the month: Foreign	during the month: Local	during the year 1930: Foreign	during the year 1930: Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	11,526	15,764	13,445	140789	8,868	110206	Nil	3	Nil	69	15,474	6,476	182788	67,334	12,260	15,396	...
Johore	...	2,264	4,607	3,766	42,758	3,799	46,747	Nil	2	Nil	25	1,427	6,165	13,292	77,347	2,207	4,639	...
Kedah	...	511	2,366	2,468	24,210	1,159	14,392	Nil	Nil	30	Nil	1,080	2,375	9,669	28,634	435	2,614	...
Perlis	...	15	6	8	96	13	159	Nil	Nil	Nil	Nil	Nil	21	Nil	266	11	10	...
Kelantan ...	...	152	133	266	3,114	82	4,151	1	Nil	35	Nil	72	351	916	6,459	114	97	...
Trengganu* ...	..	55	50	80	1,333	39	664	Nil	Nil	Nil	Nil	Nil	119	Nil	1,998	55	50	...
STRAITS SETTLEMENTS																		
Malacca ...	...	3,166	1,908	1,439	14,827			Nil	3,049	Nil	24,846	4,938		50,134		3,241	1,905	...
Province Wellesley	...	145	744	569	5,693	†										130	660	...
Dindings ...	...	140	112	100	1,175	6,136	38770	707	3,593	8,461	40,189	6,418	Nil	66,544	Nil	233	119	...
Penang	671	4,364	17	10	123											4,551	12	1,710
Singapore ...	3,345	29,056	321	190	2,657			7,314	8,860	100458	116909	16,390		233799		31,455	335	3,859

ANALYSIS OF COLONY, FEDERATED MALAY STATES AND JOHORE DEALERS' STOCKS AT END OF MONTH, IN DAY TONS.

Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley, Dindings and Malacca	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	8,963	17,378	2,725	2,521	841	32,428
Crepe	583	10,389	1,164	687	196	13,019
Unsmoked sheet ...	1,477	3,688	662	396	644	8,630
Scrap and lump ...	1,237				526	
Total all Grades ...	12,260	31,455	4,551	3,604	2,207	54,077

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less then 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, *i.e.* Column [7] = Columns [13] + [14] + [17] + [18] + [19] — [2] — [3] — [4] — [5] — [9] — [10]

3. Colony Dealers' Stocks are as published in Return I. & E 6, dated 10 January, [S. S. *Gazette* Not. No. 125], being dry weight as estimated by Dealers themselves.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked Sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I & E. 5, dated January 3, [S. S. *Gazette* Not. No. 73]. foreign wet imports being reduced to dry weight by 25%.

6. Foreign Exports of each State and Settlement are those published in the Malaya Monthly Trade Return [Appendix II] and are distinct from Ocean-Shipments as published in Return I & E. 4, dated January 3, *Gazette* Not. No. 72 [Appendix IV to Monthly Trade Return].

*7. Stocks and production in Trengganu are estimated from figures supplied by the Commissioner of Lands.

8. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore is always the most reliable.

†9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the columns comprising it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

Singapore, January 19, 1931.

J. I. MILLER, M.C.S.
Acting Registrar-General of Statistics, S.S. and F.M.S.

Summary of Padi Reports, Federated Malay States, Straits Settlements, Kedah and Perlis for the month of December, 1930.

State	District	Acreage of Padi Land	Planted Acreage	Percentage	Gross Crop	Crop per ac. 6 to 4	REMARKS.
		Acres	Acres	4 to 3	Gantangs		
1	2	3	4	5	6	7	8
Perak	PERAK NORTH						
	Krian	53,250	49,060	92			Bagan Serai five months planted: other places 1 to 3 months planted
	Larut	8,525	...				Planting almost completed.
	Selama	3,450	...				„ completed.
	Kuala Kangsar	13,997	13,797	99			„ „ and flowering commenced in some mukims.
	Upper Perak	3,739	3,739	100			Four months planted.
	PERAK SOUTH						
	Eight Mukims	14,891	3,498	23			Harvesting commenced in some mukims: others planting completed. Area of padi land revised.
		97,852					
Selangor	Ulu Langat	2,670	2,214	83			Harvesting.
	Kuala Lumpur	797	677	85			„ and grain setting.
	Ulu Selangor	1,205	1,013	84			„
	Kuala Selangor	18,564	...				„ in Jeram: Other places transplanting completed.
		23,236					
Negri Sembilan	Seremban	4,904	...				Ripening started and harvesting commenced in some places.
	Kuala Pilah	17,931	...				Flowering.
	Port Dickson	159	152	96			Fruiting.
	Jelebu	3,116	...				Harvesting.
	Tampin	2,609	1,677	64			Flowering.
	Rembau	7,897	7,296	92			do.
		36,616					

Summary of Padi Reports, Federated Malay States. Straits Settlements, Kedah and Perlis for the month of December, 1930.—(*Continued.*)

State	District	Acreage of Padi Land	Acreage Planted	Percentage	Gross Crop	Crop per ac. 6 to 4	REMARKS.
		Acres	Acres	4 to 3	Gantangs		
1	2	3	4	5	6	7	8
Pahang	PAHANG WEST						
	Temerloh	13,061	8,969	69			Harvesting.
	Raub	5,112	...				"
	Kuala Lipis	8.450	6,619	78			"
	Bentong	1,126	872	78			"
		27,749					
Straits Settlements	MALACCA						
	Central	15,723	14,861	95			Harvesting about to commence. Planted area revised.
	Alor Gajah	11,136	10,337	93			Harvesting about to commence. Planted area revised.
	Jasin	5,756	3,678	64			Planted 3 months.
		32,615	28,876	88			
	PROVINCE WELLESLEY						
	North	18,560	17,837	96			Planted 3 to 5 months.
	Central	10,539	10,316	98			" 2 to 5 "
	South	4,649	4,540	98			" 1 to 3 "
		33,748	32,693	97			
	DINDINGS	450					Planting completed.
	PENANG	4,000	3,000	75			Planted 2 to 5 months—Flowering commenced.
	SINGAPORE	Nil					

Summary of Padi Reports, Federated Malay States, Straits Settlements, Kedah and Perlis for the month of December, 1930.—(*Continued.*)

State	District	Acreage of Padi Land	Acreage Planted	Percentage	Gross Crop	Crop per ac. 6 to 4	REMARKS.
		Acres	Acres	4 to 3	Gantangs		
1	2	3	4	5	6	7	8
Kedah	Kota Star	105,060					Harvesting started on small scale.
	Langkawi	4,908					" " " " "
	Padang Terap	6,637					Planting nearly completed.
	Kubang Pasu	35,094					Harvesting started on small scale.
	Kuala Muda	13,267					" " " " "
	Baling and Sik	19,156					Planting almost completed.
	Kulim	3,642					Harvesting started on small scale.
	Bandar Bahru	2,528					Planting completed.
	Yen	19,748					" "
		210,040					
Perlis	Western Area	12,770	12,740	100			Reaping will probably be finished by middle of February.
	Eastern Area	8,820	8,540	97			Reaping just begun will probably be finished in February.
	Southern Area	16,890	14,470	86			Kayang padi in ear. Rest reaping well in progress, should finish early in March.
		38,490	35,750	93			

N.B.—The figures given in the latest return under column 3 may be accepted as more accurate than any given in previous returns.

J. GORDON-CARRIE,
Statistician.

METEOROLOGICAL SUMMARY, MALAYA. DECEMBER, 1930

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day: Amt.	Number of days: Precipitation*	Precipitation, 1mm. or more	Thunderstorm	Thunder heard	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent	Length of Day
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.							hr.	hr.	%	hr.
Railway Hill, Kuala Lumpur, Selangor ...	88.8	72.1	80.5	92	70	82	74	82.8	83.4	5.51	185.2	0.80	23	17	2	8	3		126.25	4.07	34	11.9
Bukit Jeram, Selangor ...	87.3	73.0	80.1	91	71	81	75	83.7	85.3	11.30	287.0	4.88	20	14	3	11	1		159.00	5.13	43	11.9
Sitiawan, Perak ...	87.6	72.6	80.1	91	70	82	74	83.2	84.0	9.76	247.9	1.84	19	15	7	11	1		168.10	5.42	...	...
Kroh, Perak ...	85.3	69.8	77.5	89	65	79	73	78.7	80.7	8.16	207.3	1.90	25	20	3	8	6		176.05	5.68	...	...
Temerloh, Pahang ...	86.1	72.8	79.5	90	71	77	75	82.6	84.4	7.05	179.1	1.97	22	17	...	15	5		116.00	3.74	31	11.9
Kuala Lipis, Pahang ...	86.5	71.6	79.1	91	70	74	73	82.1	82.9	15.43	391.9	3.84	26	22	8	10	17		126.25	4.07	...	...
Kuala Pahang, Pahang ...	83.9	73.5	78.7	87	70	77	75	81.6	83.9	21.87	555.5	7.68	19	17	3	6	1		166.50	5.37	45	12.0
Cameron's Highlands, Rhododendron Hill, Pahang ...	69.7	59.2	64.5	74	57	63	61	...	...	9.93	252.2	1.40	27	24	...	7	1		93.50	3.02	25	11.9
Cameron's Higlands, Tanah Rata ...	70.5	58.1	64.3	74	53	64	62	69.6	69.8	9.91	251.7	1.36	27	25	...	13	...		92.40	2.98	25	11.9
Fraser's Hill, Pahang ...	71.2	61.3	66.3	76	60	64	63	70.0	71.0	12.72	323.1	1.39	29	25	...	10	24		77.60	2.50	21	11.9
Mount Faber, Singapore ...	88.4	73.6	80.0	91	71	80	77	80.1	81.8	7.39	187.7	1.30	23	16	1	14	...		141.80	4.57	38	12.1
Butterworth, Province Wellesley ...	86.5	73.7	80.1	90	70	81	75	83.0	83.7	7.60	193.1	2.40	19	16	...	10	1		201.25	6.49	...	...
Bukit China, Malacca ...	84.9	73.6	79.3	88	71	82	75	81.9	83.4	8.15	207.0	1.51	17	12	1	4	...		160.35	5.17	43	12.0
Kluang, Johore ...	85.6	72.3	78.9	90	70	79	74	81.0	81.8	7.29	185.2	1.14	22	17	...	2	11		126.25	4.07	34	12.0
Bukit Lalang, Mersing, Johore	84.1	72.5	78.3	93	70	76	75	80.3	81.1	19.57	497.1	4.20	24	20	...	7	2		136.75	4.41	37	12.0
Alor Star, Kedah ...	88.2	73.3	80.7	91	70	83	76	85.2	85.6	10.66	270.8	2.67	23	21	1	3	2		202.40	6.53	...	...
Kota Bharu, Kelantan ...	84.5	73.3	78.9	88	71	79	76	81.6	82.9	19.77	502.2	6.25	23	17	...	2	...		155.40	5.01	...	...
Kuala Trengganu, Trengganu	84.4	73.3	78.9	87	70	78	76	80.5	81.5	17.52	445.0	6.03	23	19	...	3	2		184.40	5.95	...	...

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

METEOROLOGICAL SUMMARY, MALAYA, FOR 1930

Locality.	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Means of Monthly Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day: Amount	Date	Number of days: Precipitation, .01 in. or more	Precipitation, .04 in. or more	Bright Sunshine: Total	Daily Mean
Railway Hill, Kuala Lumpur, Selangor ...	91.3	72.1	81.7	95	69	85	74	83.6	84.0	82.80	2148.4	3.56	May 2	188	147	2285.20	6.26
Bukit Jeram, Selangor ...	89.7	72.8	81.3	93	70	85	75	86.5	86.5	57.42	1458.6	4.88	Dec. 9	165	127	2663.00	7.30
Temerloh, Pahang ...	90.0	72.3	81.2	94	69	82	75	84.7	85.7	76.80	1951.4	8.60	Oct. 30	159	130	2322.95	6.36
Kuala Lipis, Pahang ...	88.9	71.6	80.3	92	69	82	74	83.5	83.5	97.35	2472.7	3.84	Dec. 5	189	165	2245.60	6.15
Kuala Pahang, Pahang ...	86.2	74.5	80.4	89	71	82	78	85.1	86.0	110.75	2813.1	7.68	Dec. 24	185	149	2655.30	7.27
Mount Faber, Singapore ...	87.6	74.8	81.2	91	71	81	78	81.9	83.1	83.33	2167.4	3.90	June 16	173	129	2397.65	6.57
Bukit China, Malacca ...	86.2	74.0	80.1	89	71	82	76	83.5	84.7	84.97	2158.0	4.05	Ap'l. 13	178	139	2621.00	7.18
Kluang, Johore ...	88.0	71.6	79.8	93	69	80	74	81.6	82.2	79.35	2015.6	3.54	May 3	186	156	2200.80	6.03
Bukit Lalang, Mersing, Johore	86.9	72.7	79.8	90	70	81	75	81.3	81.6	91.71	2329.3	4.20	Dec. 24	...	...	2512.35	6.88
Alor Star, Kedah ...	89.6	73.3	81.5	93	70	84	76	85.9	86.3	83.22	2113.9	4.64	Aug. 31	166	149	2642.80	7.24
Kota Bharu, Kelantan ...	87.6	73.0	80.3	91	70	83	76	83.8	84.1	108.23	2749.3	6.25	Dec. 31	181	149	2488.35	6.78
Kuala Trengganu, Trengganu	87.1	72.8	80.0	90	70	82	76	82.9	83.7	119.48	3034.9	10.61	Nov. 18	185	141	2656.55	7.27
HILL STATIONS.																	
Fraser's Hill, Pahang 4268 ft. Pahang. ...	73.1	62.0	67.6	77	60	68	64	71.1	71.5	93.90	2385.2	2.42	Sept. 6	235	198	1907.15	5.23
Cameron's Highlands, Tanah Rata, Pahang 4750 ft. ...	72.4	55.7	64.1	75	49	68	61	69.5	69.4	94.78	2407.2	2.84	Sept. 7 Oct. 6	237	203	1783.65	4.89
Cameron's Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.9	59.5	65.7	77	57	66	61	...	...	98.45	2500.8	3.72	Sept. 7	237	201	1850.55	5.07

Compiled from Monthly Returns supplied by the Meteorological Branch, Malaya.

THE

Malayan Agricultural Journal.

Vol. XIX. MARCH, 1931. No 3

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THE

Malayan Agricultural Journal.

MARCH, 1931.

EDITORIAL.

Dissemination of Research Results among Agricultural Producers.

A department of agriculture cannot consider that its sole function consists in research work, but most accept the responsibility of evolving the organisation to be entrusted with the work of dealing with the practical application of such results and of passing them on in a palatable form to the producers.

The methods for the achievement of this practical application of research have varied in different countries. In the past it has been difficult for organisers to obtain very exact knowledge of the operation of schemes in other countries, so that each department has had to devise a system without the very helpful knowledge of the practice adopted in other countries.

The Empire Marketing Board has conferred a very real service on agriculture by the publication of a Report under the title "The Dissemination of Research Results amongst Agricultural Producers." This publication is a compilation of answers to a questionnaire circulated by the Board to all Empire Governments in 1927.

Sir Daniel Hall, in an introduction to the volume, traces the steps that appear to be most generally applicable in rendering science of use to primary producers. He states that the discoverer has fulfilled his purpose if he has arrived at a principle; he is rarely interested in the details whereby it can be translated into practice, for which he may not have facilities. The results should reach the staff of instructors and means should be devised of keeping them in touch with developments of their subject. For this purpose he stresses the value of annual meetings of organisers, instructors and advisers, when the investigators can expound both their own and parallel work.

The recent agricultural conference in Kuala Lumpur is an instance of such organisation which has been found most helpful, not only to the instructors—in this case the field staff of the Department—but to the research staff.

Another aspect of the subject is discussed by Sir Daniel Hall—that of general information concerning improved farming which the ordinary cultivator or stock-keeper requires. Such producers fail because they do not utilise common knowledge—scientific or practical. He states that with "the bulk of farmers in any country, the problem is how to bring home to them not so much

the results of recent research but the common facts upon which their calling is based—practical, scientific and economic. This is the task of the educational service, and if the educational service is effective very little need be done to ensure that it will pass on all the practicable results of recent research."

It is suggested that there are three classes of producers. Firstly, the plantation industries growing a single crop on a large scale. " The managers of these industries require highly specialised information proceeding from investigation. They are receptive of such information and are generally ready to adopt it. From the point of view both of investigation and of the dissemination of information they can best be served when the individuals will associate and assist in the maintenance and direction of a special experiment station devoted to their industry only, however closely this station may be associated with or administered by the Department of Agriculture."

For meeting the needs of the second class—the great mass of primary producers—generally farmers cultivating more than one crop—Sir Daniel remarks that their need is not so much technical knowledge as character, energy and developed intelligence and it follows therefore that the factor determining their quality as farmers will be their general education as human beings. But putting aside the organised instruction of young persons by formal methods there is agreement that effective work among adults comes with personal contacts. For this purpose, personal visits to holdings, visits of farmers to demonstration and experimental farms and plots and meetings for discussion are especially advocated. Lectures, broadcasting, films, bulletins and journals all suffer from the disability of less intimate personal contract. Any educational effort in which the students are led to play a part, in which they are active participators, leads to more permanent results than other forms of instruction. As a means to this end, exhibition trains and motor vans are mentioned.

Thirdly is instanced the very large and important class of non-European cultivators in tropical countries. For this class demonstration is particularly effective.

From the foregoing summary of the opinions of an eminent student of agriculture we must leave the reader to estimate to what degree the extensional services of the Department of Agriculture, the Rubber Research Institute and the Co-operative Department satisfy the needs of Malaya. We have problems peculiar to ourselves and for these we must devise our own solutions, but in many respects the problems of Malaya are but a replica of those in other colonies, and we can therefore gain much knowledge of the subject by study of the publication referred to above.

Control of Rats. Some idea of the seriousness of the rat menace in Malaya may be gathered from the fact that as a result of the Rat Campaign in the Krian District of Perak, 1,791,790 rats were destroyed in 1930. The area covered by this work is the 50,000 acres of the Krian Irrigation Scheme. In the neighbouring territory of Province Wellesley, 1,514,928 rats were

accounted for in 1930. The area covered by this campaign is rather less compact than that in Krian.

One would naturally anticipate rat trouble in padi-growing districts, but in the present instance there are two rather arresting facts in connection with these results. Firstly, the number of rats accounted for is less than the total number killed, for poison is extensively employed in the campaigns; and secondly—and more important—the campaign in Krian is no spasmodic endeavour of the Government to restrict rat damage, for the work has continued incessantly in the District for the past six years, during which period over 5,500,000 rats have been destroyed—an average of over 20 rats per acre per annum. It needs no flight of imagination to visualise the destruction of padi which would have been occasioned in the absence of such control measures. The average cost has worked out at about 2 cents per rat, so that the results have been commensurate with the cost. It is estimated that the annual saving of padi by reason of the rat campaigns in Krian and Province Wellesley alone is sufficient to feed 12,000 people each year.

The necessary for rigorous rat control is not confined to padi-growing districts. Oil palm and coconut estates, for instance, experience considerable damage by these rodents.

Mr. F. W. South contributes an article in this number on " Rat Destruction in Malaya " which enumerates the methods which have proved efficacious in the Government campaigns in this country and embodies the experience gained by planters who have found it necessary to inaugurate schemes covering the areas under their control.

We would emphasise two points that emerge from these campaigns; rat control necessitates continued effort and can only be really successful where a variety of methods of destruction are employed.

Original Articles.

RAT DESTRUCTION IN MALAYA

BY

F. W. South,

Chief Agricultural Field Officer.

During the year 1924 Sir George Maxwell, then Chief Secretary to Government, suggested that a special campaign for the destruction of rats in padi fields might yield useful results. Consequently, work was commenced in a definite portion of the irrigrated padi area in Krian on the 15th. November, 1924. This campaign had three objectives in view. It was intended to destroy as many rats as possible before the padi harvest; it was also intended to arouse among local padi growers a greater and more practical interest in rat destruction; and finally, it was expected to provide information regarding the best methods of rat control.*

This campaign proved so successful that it was extended in 1925 to include the whole of the padi area in Krian, while in 1927 a similar campaign was commenced in Province Wellesley and in October, 1929 in Malacca.

Use has been made of the experience gained to arouse an interest in rat destruction among Malay padi growers in all parts of the Peninsula. Information on rat destruction has been conveyed to the public by means of pamphlets in Malay and in English and by special exhibits staged at Agricultural Shows.

Moreover, control of rats has proved to be of considerable importance on oil palm estates, since these animals eat the buds of recently planted young palms, gnaw through the leaf stalks of palms about two years old and eat the ripe fruit on mature palms. Rats are also a serious pest in clearings of young coconuts, where they eat the buds as they do in the case of young oil palms, and in clearings on rubber estates recently planted with germinated seed, seed at stake, young seedlings or baskets plants. Numerous requests have been received during the last two years for advice on the control of rats and the experience gained in the padi fields has been of value in enabling recommendations to be made for similar work on estates.

In the present article some recent information on methods of destruction is given together with a short review of the results obtained both on estates and in padi fields. The information has either been kindly supplied by estate managers or taken from reports submitted by the Agricultural Field Officers and the three Rat Destruction Officers stationed in Krian, Province Wellesley and Malacca respectively.

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* Malayan Agricultural Journal, Vol. XIII, pp. 168 and 364.

Methods of Destruction.

Three methods of rat destruction have been used; namely, trapping, poisoning and hunting. Poisoning has consisted mainly in the use of poisoned baits, but the injection into rat burrows of calcium cyanide dust, yielding a poisonous gas, has also been tried. The term "hunting" is here used to include both organised rat hunts and the digging out of nests of young rats during the main breeding season.

Trapping.

The persistent and methodical use of traps has proved to be one of the most satisfactory methods of destroying rats. Fuch's Steel Rat Traps, of the guillotine type, have been found convenient and economical for this purpose. The various types of traps made locally by Malays, mostly on the dead-fall principle, are also effective.

Baits for traps must be carefully chosen. If one kind does not prove attractive another must be tried. If trapping has to be maintained continuously, it is desirable to change the baits fairly frequently. On estates, rubber seeds, pieces of coconut—either alone or dipped in coconut oil—and padi grains have proved successful. In padi fields, padi grains are most commonly used, but dried prawn is also satisfactory. Small pieces of tapioca root or of sweet potato are also likely to be attractive. Baits should always be clean and fresh and should be handled as little as possible. Traps in which rats have been killed should be cleaned before further use. Some years ago, during an outbreak of rats on coconut estates, it was believed that traps dipped in coconut oil before being placed in position caught more rats than undipped traps.

Rats are intelligent and cautious animals to which the scent of their natural enemy, man, is often stated to be repellant. For this reason it is customary to recommend that the handling of bait should, so far as possible, be avoided and that, when setting traps, precautions should be taken to avoid or mask the human scent. Such precautions are rubbing the hands in earth before handling the traps, or dripping the traps, after setting, in coconut oil. In a recent article Schander and Gotze * express the opinion that the human scent does not much affect rats and state in support of this view that bread carried for a time in human armpits was readily eaten by rats. On the other hand, these authors admit that rats very quickly associate its particular smell with anything harmful to them. Consequently, the possibility remains that, in a community in which a number of rats are being killed by traps carrying the human scent, the survivors will learn to associate the scent with danger to themselves. The same argument applies to the smell of coconut oil or of any bait used. Hence the necessity for

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* Zentralblatt fur Bacteriologie, Parasitenkunda und Infektions-krankheiten, Band 81, Sept. 1930, p. 342.

frequent changes of bait and of avoiding the too continuous dipping of traps in coconut oil.

In order to set an effective number of traps in each acre simultaneously throughout the whole of a large estate, a very large number of traps would be required and an appreciable number of labourers would have to be employed. For continuous work this would involve considerable expense. Consequently, it has been suggested that the estate be divided into a number of convenient areas and that traps be set in a few of these on one night and in an equal number on the next night, the areas being so arranged that traps are set in each once in seven to ten days and that the areas worked on any one night are at a considerable distance from those in which traps were set on the previous night. On oil palm estates it is suggested that the number of traps should be about one to each palm.

In padi fields, traps are placed at intervals on the bunds. Whether in padi fields or on estates they should be placed near rat runs, rat holes, suitable cover for rats or damaged plants.

Poisoning.

The poisons which are generally used are commercial sodium arsenite or barium carbonate. Experiments have also been conducted with the proprietary poison Zelio Paste.

(a) *Sodium arsenite.* Various baits have been tried with this poison, but that which has proved most consistently satisfactory in the padi fields of Krian and Province Wellesley is made up on the following formula :—

Sodium arsenite	1 part by volume
Rice polishings	4 parts „ „
Dried fish or prawn	1 part „ „

Enough coconut or palm oil is added to bind the mixture into a stiff paste. A little water can also be added if necessary.

The ingredients are thoroughly mixed and then rolled into small balls.

When a large number of such balls are needed they can conveniently and cheaply be prepared by the following method, which has been worked out by the Agricultural Field Officer Selangor, Mr. Doscas. The ingredients in the proportions given above are thoroughly mixed in an earthenware water jar, the smaller size of " Shanghai jar " is suitable, and the paste is then passed through an ordinary culinary mincing machine, using the medium cutter. As the material is delivered from the machine it is sprinkled with rice polishings and rolled into balls by passing the hand over the mass once or twice with a circular motion. The balls are then placed in a gunny bag well sprinkled with rice polishings and rotated quickly up and down; finally the balls are laid on sacking to dry and set for about twelve hours, after which they can safely be transported in cases. The balls are preserved by the arsenic and will keep indefinitely.

The hands of all the coolies engaged in preparing the baits should be well smeared with oil of aniseed before commencing work; by this means the human

smell is masked and the baits are given an aroma which is attractive to rats. The scent rapidly disappears, but can be renewed by introducing a few drops of aniseed oil into the case before use.

Arsenic is a very dangerous poison and should not be used in situations where it is easily accessible to children or domestic animals. For the same reason, coolies who have been handling the poison or poisoned baits should be made to wash their hands and arms very thoroughly as soon as they stop work. The stock of poison should be kept in a strong, locked receptacle.

The balls are easily dissolved by rain and for this reason should be put down in sheltered positions during wet weather, or inside short lengths of bamboo. The latter method has the added advantage of rendering the baits almost inaccessible to most domestic animals.

Another very effective form of bait is a grasshopper or dragonfly. To prepare the bait the insect is caught and killed. Its body is slit open and filled with a small quantity of poison. The insects thus prepared are placed in as natural a position as possible on clear parts of the bunds of padi fields or in convenient places near the individual growing plants on estates. Rats seem unable to resist these insects and will take them continuously, apparently not becoming suspicious of them as they do of artificial baits.

Other baits mentioned as used on one estate are rice, padi or rice bran boiled and mixed with poison at the rate of 6 gantangs (gallons) of the bait to 6 cigarette tins of sodium arsenite; on another estate, tapioca, sweet potato, rubber seeds, a mixture of bran and crushed prawn ('blachang') and also of bran and coconut fried with groundnut oil have been used as baits. No definite results from the use of these different forms of bait are recorded.

(b) *Barium carbonate.* This poison is less dangerous to human beings than is sodium arsenite. For use in poison balls, prepared in the same way as with sodium arsenite, the mixture is made on the following formula :—

Barium carbonate	2 parts by volume
Rice polishings	4 parts ,, ,,
Dried fish or prawn	1 part ,, ,,

Coconut oil or palm oil are added, with water if required.

Barium carbonate can also be used in baits of grasshoppers and dragonflies as already described. On one oil palm estate the fruit bunches are lightly sprinkled with this poison, a method which has proved very effective, numbers of dead rats being found on the area regularly so treated.

Poison balls made with barium carbonate have to be used promptly, as this salt has not the preserving action of arsenic and the balls soon become mouldy and develop an unpleasant smell.

Barium carbonate causes the poisoned rats to become thirsty and to search for water, so that dead rats are most commonly found in or near water.

(c) *Zelio paste* is a proprietary preparation containing thallium sulphate. The quantity required to kill a rat is about 0.2 gram. When not fatal, the poison is stated to affect the reproductive organs, rendering them sterile.

Zelio paste, spread on small pieces of bread, has been tried in buildings in Europe. In April 1930 it was tried in the Bagan Serai rice mill with Chinese sweet cake as bait. The poison was spread on two slices of cake which were then made into a sandwich and cut into small pieces about ½ to ¾ inch square. Of 104 baits put down 53 were taken in the course of one week, but no dead rats were found although these animals were reported to be plentiful in the mill.

In Province Wellesley the paste has been made up into poison balls with the same mixture of rice polishings, dried fish and coconut oil as is employed with sodium arsenite. Of 494 baits put down in May in shops, houses and mills all were taken within twenty-four hours and 240 dead rats were found. In rice fields the results were not so good, though comparable with those obtained with sodium arsenite. Of 345 baits put down during April, 193 were taken in two days and 45 dead rats were found, while elsewhere of 200 baits 79 were taken in one day and 37 dead rats were found. In the same neighbourhood, but somewhat later in the month, 450 baits made with sodium arsenite were put down. Of these 145 were taken in 24 hours and 76 dead rats were found. The number of dead rats found is not a reliable indication of the effectiveness of the baits, since the rats often die in a thick cover of grass, weeds or bush and are not found. It will, however, be seen that of the baits made with Zelio paste approximately the same percentage were taken as of those made with sodium arsenite.

In July 300 balls made with Zelio paste were put down. In a maximum period of three days 155 were taken and 12 dead rats were found. In this trial it was believed that the quantity of poison in the baits was insufficient, the available supply at the time being rather limited.

In October a further trial was carried out in Province Wellesley, the baits being made up on the following formula: Zelio paste 5½ oz., Rice Polishings 72 oz., Coconut Oil 10 oz., Dried Fish 8 oz., a few drops of oil of aniseed were added. This mixture gave 833 baits. The results obtained are shown in the following table:—

Locality.	*Date.*	*No. placed.*	*Date examined.*	*No. taken.*	*Dead rats found.*
Northern District	6-10-30	300	7th & 9th	63	6
Central District	do.	333	do.	75	9
Southern District	do.	200	do.	154	79
		833		292	94

The presence of much water in the padi fields of the Northern and Central District interfered to some extent with the trial.

In December another experiment was carried out in Province Wellesley.

The formula used for mixing the baits on this occasion was :—Zelio Paste 6 ozs., Rice Polishings 55 ozs., Coconut Oil 7½ ozs., Dried Fish 6 ozs. A few drops of aniseed oil were added. This mixture gave 663 balls which were put down on December 26th. in a patch of tall, thick sedge. On the 28th. 74 dead rats were found and it was estimated that 546 baits had been taken.

In preparing these baits, the coconut and aniseed oils and Zelio paste were thoroughly mixed together in a mortar. The rice polishings and dried fish were mixed in a basin and the oil and paste mixture was then slowly added, the whole being thoroughly mixed until the required consistency was obtained.

The results recorded with Zelio paste have been promising. Further trials are contemplated and the cost of the poison is being compared with that of sodium arsenite.

Use of Aniseed Oil. As it appeared doubtful whether the addition of oil of aniseed to baits rendered them more attractive to rats, a series of experiments was carried out in Province Wellesley to decide this point.

The poisoned balls used were made by mixing 22 ozs. of sodium arsenite, 72 ozs. of rice polishings, 10 ozs. of coconut oil and 8 ozs. of dried fish. This unit mixture was used to make 600 balls. To one unit a few drops of oil of aniseed were added. A second unit was made without this oil. The balls were put down in small groups at regular intervals, a group with oil of aniseed alternating with a group not containing the oil. The number of balls in each group was the same.

Of 1,200 balls not containing the oil 429 were taken in one or two days, 96 dead rats being found. Of the 1,200 balls containing oil of aniseed 752 were taken in the same period and 185 dead rats were found. Thus the baits made with oil of aniseed were considerably more attractive than those without it. In these experiments, as in those with Zelio paste, the number of dead rats found is not a reliable measure of the success of the baits. More importance attaches to the number of baits taken. These results are in opposition to those recorded by Schander and Gotze. In their article already referred to the authors state that their feeding experiments gave no proof of any preference on the part of rats for aniseed oil. They also drew attention to the danger that rats would learn to associate harm to themselves with any strong smell from aromatic substances used in the preparation of baits and emphasised the need for frequent changes of baits and aromatic substance.

Rat Virus. It has been claimed that certain species of bacteria cause deadly and very infectious diseases among rats. Carefully prepared cultures of these bacteria are sold as different kinds of rat virus, such for example as Liverpool Virus, Danysz Virus and the Virus, *Bacillus typhi murium*, prepared by the Pasteur Institute in Paris. It is, further, often claimed that the diseases caused by the bacteria in these various types of virus are harmless to man and to domestic animals.

Unfortunately, the virulence of any particular virus is liable to wide variation, even among different samples prepared in the same way, and in consequence their

action is unreliable. Moreover, by no means all rats which eat baits impregnated with virus are killed and those that survive become immune and may possibly give rise to partly immune offspring. It has also been found that the diseases caused by the different types of bacteria are often not readily contagious, so that, even with a virulent strain of virus, only the individual rat which eats the impregnated bait is killed; the effect being then the same as that of a chemical poison.

Another objection is that some strains of these bacteria may not be so harmless to man and to domestic animals as they were at first thought to be.

The most important objection, however, to the use of any form of rat virus in Malaya is the harmful effect upon it of comparatively high temperatures. This would necessitate the use of cool storage both during the transport of the virus from Europe and during its storage in this country.

Moreover, for successful use a virus must be comparatively freshly prepared. Consequently, either fresh supplies would have to be imported at short intervals. or a supply would have to be maintained locally. Since much work is involved in maintaining a supply of virus of a high degree of virulence, it is more than doubtful whether the uncertain results obtainable would justify the cost of producing a local supply.

In view of the objections mentioned above and of the satisfactory results obtained by other methods, the use of any form of virus in this country is not at present recommended.

Effectiveness of Poisons. The chemical poisons described above are by no means rapid in their action and may require 24 hours or more to cause death. For this reason poisoned rats are able to move to some distance and hide, in burrows or thick cover, so that a number of those killed are not found.

The comparative absence of dead rats often leads to a belief that the poison used is ineffective. The tables given above, however, show that this is not the case and this view is supported by other evidence in the possession of this Department. Very recently a Malay Headman produced figures to show that of over 12,000 dead rats recorded in a padi area in Selangor only about 2,000 had been caught in traps, while the remainder were found dead during a period when poisoned baits were in regular use in these particular padi fields. Experience is convincing the Malay padi growers of the value of poisoned baits for which there is now a big demand in most parts of the country.

It must, however, be remembered that rats soon learn to recognise poisoned baits, especially if they are left about as they have to be when used on a large scale under field conditions. In wet weather most of those left uneaten probably dissolve and are washed away in a few days, but in dry weather they remain for some time and tend to increase the suspicion of the rats. Consequently, a new kind of bait should always be tried whenever it is fairly obvious that the bait in use is not proving successful.

Calcium Cyanide Dust. Reference was made to the use of this substance in an article on page 168 of Vol. XIII of this Journal. Although the dust proved

effective, little further use has been made of it. It is so dangerous a poison, owing to the evolution of hydrocyanic acid gas, that its use has to be restricted to carefully trained labourers.

In some parts of the country rat burrows are common in the bunds of padi fields during the drier weather, and the injection of this dust into them certainly kills a large number of rats. The work, however, requires close supervision and trained labour involving considerable expense. Moreover, where a reward is offered for each rat tail, Malays and Tamils prefer to dig out the rats with their young so that they are able to claim the reward.

Hunting.

The use of this method in padi fields was described in Vol. XIII, p. 168 of this Journal. It has not become widely popular among Malays as yet, though it is gradually being adopted in areas where rewards are offered. Its use is mostly confined to the period when the padi fields are being cleared of weeds or to the time of harvest. Thus, organised drives were common throughout Province Wellesley in July 1930 when the land was being cleared for planting. In such cases an area of about 1 acre of weeds was cut from the outside inwards, the rats sheltering in the centre. Cutting was continued until only about ¼ acre of weeds remained and was then stopped until the children returned from school. The boys, armed with sticks and other handy weapons, then surrounded the patch and killed all the rats that ran out as their elders completed the cutting.

Certain oil palm estates rely mainly on hunting for the control of rats. The labourers are encouraged, by the offer of rewards of 1 or 2 cents a tail, to turn out in the evenings with their dogs and hunt rats. In this way between 2,500 and 3,200 rats are destroyed each month on one estate.

Another form of hunting consists of digging out rats and their nests from the bunds of padi fields. This method was extensively employed by Tamils in Province Wellesley during the dry weather following the padi harvest in 1930. In the Province, as probably in other parts of the country, the rats appear to breed most prolifically in the two or three months just after the padi harvest when the supply of food is plentiful, that is in March, April and May. During these months the rats accounted for in the Province were respectively 76,489, 116,522 and 137,345, of which the greater majority were very young animals brought in by professional Tamil rat-catchers, though some were collected by Malay school children under the leadership of their teachers.

General Observations.

Experience shows that in localities such as padi fields and oil palm estates, where rat control has to be maintained continuously, reliance should be placed on intensive trapping and poisoning, aided by hunting when practicable. All such efforts must be sustained. Spasmodic efforts are useless and only result in a

waste of money. On oil palm estates work must be continuous throughout the year; in some padi growing areas, however, it is possible that rat destruction could be discontinued without any ill effects during the two or three months immediately preceding the time when the land is cleared for planting. This point will receive investigation.

Rat control on oil palm estates is assisted by the removal of any forms of cover such as jungle stumps and logs. Thick growths of close-growing cover crops afford cover for rats, provide in their seed a plentiful supply of food and handicap all methods of rat destruction. Consequently, it has been suggested that cover crops should not be grown on flat land planted with oil palms, since their disadvantages are liable to outweigh their advantages.

Removing Cover in and around Padi Fields. In the areas where definite rat compaigns are being conducted, it has been found that the damage done to the standing padi crop by rats is confined to the neighbourhood of places which afford protection or cover for these animals. Consequently, such damage can be materially reduced by cutting down all patches of high growing grasses or bushes in the immediate neighbourhood of the padi fields and by taking such action as is possible to ensure that all the padi land is cultivated, since any portions left unplanted are usually covered with a dense growth of weeds in which rats can harbour, often in considerable numbers. While the cutting of heavy growths of weeds in and around padi fields is not in itself necessarily sufficient to prevent rat damage to the standing crop, yet experience shows that it is a useful adjunct to the methods already described for the destruction of the rats.

Results.

Both in Krian and in Province Wellesley a special staff consisting of a European Rat Destruction Officer and a few Malay Assistants has been employed to direct and supervise the rat campaign. Poison balls have been distributed, usually free of cost, and rat traps have been sold at cost price. Rewards of one cent a tail were paid for all tails collected until the 31st. of October 1930, since when the reward has been reduced to ½ cent a tail. The numbers of tails for which rewards have been paid are shown in the following summary :—

		Krian.		*Province Wellesley.*
1st. November 1924 – 31st. December	1925	661,794		......
	1926	673,102		......
	1927	842, 791	Sept. 1st. to Dec. 31st.	100,000 (over)
	1928	914,644		509,151
	1929	623,712		579,972
	1930	1,791,790		1,514,928

In addition, a number of rats have been killed by poison and have not been found. It is roughly estimated that rat damage has been reduced from about 6 per cent. to about 1 per cent. of the standing crop in these two important padi growing areas. Since the average total crop for both is 25,000,000 gantangs (gallons) of padi a year this saving represents 1,250,000 gantangs of padi a year.*

In Malacca the campaign has been in operation throughout 1930. At first the Malays were unwilling to bring in rat tails and claim the reward of 1 cent each, but later collections were made through the schools while Chinese also become interested, with the result that rewards were paid for 75,817 rats during the year. Much attention was given to the removal of suitable cover from the surroundings of padi fields and, on the whole, the work has resulted in a satisfactory diminution in the damage done to the standing crop.

In other parts of the country rewards are not paid and no special staff is provided. The District Officers and the Agricultural Field Officers co-operate to make traps and poison available at cost price; pamphlets are distributed and Malay officers constantly give advice on all the measures recommended for reducing damage to padi by rats. Such action has roused considerable interest among Malay padi growers, notably in the Negri Sembilan and Pahang in which States much useful work has been done during 1930.

Estates have made use of different methods or combinations of methods of rat control. An indication of the results obtained is given in the following summary of information supplied by managers of estates.

On a clearing of 600 acres planted with germinated rubber seed 150 traps were set daily. The only bait which the rats would take was rubber seeds. The average catch for the first few days was 45 rats a day. This gradually decreased to an average of 25 a day. The decrease in damage to the young rubber plants was marked.

Another rubber clearing of 300 acres was planted with seedling and basket plants early in August 1930. To protect these, rat control measures were commenced in the previous June. Poisons and traps were used. Up to the end of November 657 rats had been trapped. Only two poisoned rats were found, but, as up to the date given not a single plant had been damaged, it seemed probable that the poison was more effective than the number of dead rats would indicate. At the end of the year the rubber trees were becoming too old to be subject to damage by rats. On this estate a poisoned bait was placed beside each hole before planting and a second supply of baits was put out after planting.

Two oil palm estates rely on hunting for rat control, the labourers being encouraged to hunt by the payment of rewards. This measure has met with a fair degree of success. On one of these estates grass and a cover crop are grown, but the Manager states that although they give a certain protection to the rats he does not think they have a serious effect on control measures. On the other estate one division is also under a mixture of grass and cover crops and

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* A gantang of padi weighs about 6 lbs.

the Manager states that on this division hunting has proved less successful. Poison has also been used, but the results obtained are uncertain, since the rats make for water after taking the poison and are not seen again.

Finally one estate makes use of different combinations of control measures according to the age of the oil palms to be protected.

One area consists of six year old palms in bearing. The area is under grass but is widely circle-weeded. The bunches of fruit are lightly sprinkled with barium carbonate which has proved very effective, numbers of dead rats being found. Every evening coolies hunt through this area for a reward of 2 cents a tail, obtaining on an average 50 tails a day. This system is effective since, though a proportion of the fruit is eaten by rats, serious damage and loss of fruit is prevented.

In another section of three year old palms commencing to fruit, the fruit bunches are sprinkled with barium carbonate and poisoned baits are set near any trees damaged by rats. This method is also reported to be successful.

In another section of two year old palms trapping and poisoning are systematically employed with success, no serious damage having so far been caused to the palms.

In both these sections there is a cover of Centrosema and the Manager expresses the opinion that this not only harbours rats, but offers them food and excellent breeding grounds from which they cannot be removed.

Finally, on an area of 1 year old palms no cover crop has been planted and the area has been kept clean weeded. Rats are stated to be unknown and most of the palms are unguarded. Up to the present not one palm has been touched by rats.

Two other planters state definitely that serious rat damage previously experienced ceased after the cover crops present had been removed and a third attributes freedom from rat damage to the absence of a cover crop. The Principal Agricultural Officer, Johore, endorses these views by stating that in his experience successful rat control measures are practically impossible in areas where heavy cover crops have been established and that the removal of such cover crops is the first step to take when rats have become a serious pest.

In conclusion, it may again be emphasised that only organised and persistant control measures will afford satisfactory protection against rat damage to such crops as padi and oil palms, while any relaxation of control is liable to result in a rapid increase in the number of rats and the consequent waste of much of the money previously spent.

POLLINATION OF OIL PALMS UNDER FIELD CONDITIONS

BY

J. N. MILSUM AND J. L. GREIG,

Assistant Agriculturists.

Introductory.

In previous issues of the *Malayan Agricultural Journal* (vide Vols. XIV, page 384; XVI, page 20; XVII, page 16) papers were published recording the results obtained by pollinating artificially a number of oil palms under avenue conditions. The experiment conducted over a period of three years, showed conclusively, that under conditions obtaining a considerable increase of crop resulted from artificial pollination, while the growth of the two sets of palms showed no material difference. Subsequent records for the years 1928 and 1929 respectively show similar results.

It must be admitted, however, that this experiment is open to criticism, since the palms are not growing under normal estate conditions and further, no attempt was made to examine the crop records from a statistical standpoint.

Description.

The experiment under consideration comprises an area of approximately 20 acres of oil palms (*Elaeis guineensis*) growing on undulating land at the Government Plantation, Serdang. The soil may be described as quartzite clay loam with occasional intrusions of underlying laterite, typical of the inland soils of Selangor. The land is undulating, and silt-pitted throughout at the rate of one silt-pit per palm.

The palms are planted 30 ft. by 30 ft. triangular, i.e. 55 palms per acre. Pollinated palms and control palms are in alternate rows throughout the entire area under experiment. The total number of rows is 68, of which 34 alternate rows are under treatment and the remaining 34 rows serve as a control.

The palms were planted in May, 1922, and commenced to bear fruit during the latter part of 1925. Artificial pollination commenced in January, 1926 and has been carried out continuously since that date. The results published in the present paper are those obtained during a period of over four years, namely from October 1926, until December 1930.

Method of Pollination.

The palms receiving artificial pollination were patrolled every alternate day and a maximum of one female inflorescence per palm pollinated every five weeks, i.e. approximately ten pollinations per palm per annum. Fruit bunches were

harvested as they became ripe from both sets of palms and recorded monthly as total number of bunches and their weight. Owing to the large number of bunches handled it was not found practicable to record the actual weights of cleaned fruit harvested. It may be safely taken, however, that the percentage of fruit to bunch in the pollinated bunches is greater than in the case of unpollinated bunches. The weights of bunches were, in every case, taken in the field to prevent confusion. The inflorescences receiving artificial pollination were marked and dated on the leaf base in the axil of which the inflorescence arose, in order to determine whether the following inflorescence came within the pollination cycle or not.

Yields.

In the following tables the yearly number and weights of bunches are recorded. Table I represents a summary over the entire period. Under the heading of pollinated palms, the crop records are divided under two sub-headings, namely, pollinated bunches and unpollinated bunches, the latter being those bunches which have been pollinated by natural agencies. The percentage increases of crops harvested from the pollinated palms over that from the control palms for the period 1926-1930, are shown in Table II. Table III gives a comparison of the annual average weight per bunch for pollinated and unpollinated bunches. The column on the right shows the percentage increase, per bunch, of the artificially pollinated bunches over the controls.

A statistical examination of the results was undertaken in order to determine whether the conditions obtaining in both control and pollinated palms, other than artificial pollination, were the same. The method employed is that described by Fisher, (vide "*Statisitical Method for Research Workers*" by R. A. Fisher, 1925, page 109 et seq.); to test whether two samples belong to the same population or differ significantly in their means.

Taking the monthly yields as observations when t was calculated for the period October 1926—June 1930 there was a significant difference between the means of the pollinated and controls. t was also calculated for the average weight of naturally pollinated bunches from both control and pollinated palms. There was no significant difference between the means which showed that the average bunch produced by both sets of palms when naturally pollinated were the same.

t was ascertained in the same way for the period October 1926—December 1930 with slightly different results. Taking the monthly yields there was a significant difference as before.

When t was calculated for the average weight of naturally pollinated bunches a significant difference between the means was found. The mean average weight taken over monthly readings of the control palms was significantly greater than the mean average weight from the pollinated palms. The apparent explanation is that the naturally pollinated bunches are not maturing to such a large size on the pollinated palms, since the palm is maturing 103.9 per cent. more fruit than

TABLE 1.

Summary of Yields 1926-1930.

Year.	Pollinated Palms.						Control Palms.		Remarks.
	Pollinated Bunches.		Unpollinated Bunches.		Total of previous two columns.				
	Number	Weight lbs.	Number.	Weight lbs.	Number.	Weight lbs.	Number.	Weight lbs.	
1926	311	4,383	506	3,596	817	7.979	607	3,371	October—December.
1927	1,552	27,398	1,618	9,836	3.170	37,234	2,809	18,061	
1928	1,862	50,462	1,729	13,408	3,591	63,870	3,214	28.912	
1929	1,983	60.301	2,204	31,344	4.187	91,645	3,345	49,806	
1930	2,287	78,882	2,466	33,895	4,753	112,777	3,386	53,578	
Total	7,995	221.426	8,523	92,079	16,518	313,505	13,361	153,729	

TABLE 2.

Percentage Increases. Period 1926-1930.

Year.	Pollinated Palms. Total weight of bunches.	Control Palms. Total weight of bunches.	Percentage Increase Pollinated Palms and Control Palms.
	lbs.	lbs.	
1926	7,979	3,371	136.6 per cent.
1927	37,234	18,061	106.1 ,,
1928	63,870	28,912	120.9 ,,
1929	91,645	49,806	84.0 ,,
1930	112,777	53,579	110.5 ,,
Total ...	313.505	153,729	103.9 ,,

TABLE 3.

Average Weight per Bunch per Annum for Pollinated and Control Bunches.

Year	Pollinated lbs.	Control lbs.	Percentage increase.
1926	14.09	5.55	153.87 per cent.
1927	17.65	6.43	174.49 „
1928	27.10	9.00	201.1 „
1929	30.41	14.89	104.23 „
1930	34.49	15.82	118.02 „
Average for whole period	27.70	11.51	140.66 „

the control palms by weight and 70.6 per cent. of this crop is produced on artificially pollinated bunches weighing 140 per cent. more.

Summary.

1. A field pollination experiment with 20 acres of young oil palms, conducted during a period of 4¼ years is described.

2. The percentage increase of crop due to artificial pollination is shown to be 103.9 per cent. for the period. Further, the bunches pollinated artificially show an increase in average weight over the bunches from the control palms of 140.66 per cent. for the whole period.

3. The results have been examined statistically and show no material difference in average weight of naturally pollinated bunches from the two sets of palms. On the other hand, there is a marked significant difference between the weight of bunches harvested from the artificially pollinated and control palms. Hence, it may be deduced that the crop increase is due solely to artificial pollination.

FACTORS OF QUALITY IN COPRA

BY

F. C. Cooke,

Assistant Chemist for Copra Investigations.

Well prepared copra is white, of low moisture content and brittle, the pieces of copra being of good size and without " smalls." The meat is of good thickness and has a high oil content. If these conditions are satisfied, the copra will arrive in Europe insect and mould free, white and sweet.

Colour.

Besides yielding a colourless oil, white copra also yields a light coloured cattle cake. Caramelised, superficially burnt, or black copra yields an oil of varying redness which may in some cases be only partially bleachable and a cattle cake which the farmer will reject on appearance and perhaps also because of the smell of associated distillation products from the drying fires. It is also suspected, but not yet confirmed, that insects are especially attracted by slightly burnt copra, particularly where cell rupture has occurred.

Moisture.

Wet copra is the standard product bought by the local dealers in native copra because at certain seasons of the year—notably in November and December—it is impossible to sun-dry copra satisfactorily in this country. During the day the air is about 79 per cent. saturated with moisture while at night the relative humidity averages 95 per cent. Apart also from seasonal fluctuations, humid days and relatively dry days alternate irregularly so that it is impossible to work on standardised lines in order to obtain a standard product either by sun-drying alone or by kiln-assisted sun-drying. Careless preparation, therefore, becomes the rule and local dealers adjust their prices accordingly.

In Table I, certain records are given relating to the atmospheric conditions existing in an important coconut district and from these figures an approximate estimate may be made that in the most humid month it takes four times as long to sun-dry copra as during the driest month, while on certain days it will be quite impossible to effect any drying. Thus in the month of November, a piece of wet copra (moisture about 50 per cent.) was exposed in the sun for five days by which time it still contained 35 per cent. of water and was heavily covered by a multi-coloured mycelium of copra moulds.

To make matters still worse, there is the added factor of heavy moisture generation when such badly prepared native copra is stored under unsatisfactory conditions (see later).

TABLE I.*

Atmospheric Conditions on the Selangor Coast (Bukit Jeram).

1929 Mean Hourly Values For Relative Humidity (Day).

Hours :—	9	10	11	12	1	2	3	4	5	6
July ...	78	74	71	68	68	67	67	69	70	74
November ...	86	81	75	74	74	75	76	79	83	88

Mean Values.

	Day (10 hours)	*Night (14 hours)*	*24 hours.*
July	71	88	81
November	79	95	89

	Hours of strong sunshine. (daily mean).	*Strong windy days.*
July	8.5 hours	1 day
November	6.4 hours	3 days

Relative Drying Power of air (Shade).

Assume no drying at about 80 per cent. humidity.

	Day	*Night*
July	96 units	0
November	27 units	0 (? with moisture reabsorption).

At this stage the related question of moisture reabsorption might be considered. While it is claimed for the Philippines (1) that 5 per cent. moisture represents approximately the stable moisture content in copra there, the Malayan figure depends on the time of the year and, of course, on the structure of the copra. A skinned over or "case-hardened" copra will naturally take up moisture more slowly than a uniformly dried piece of copra (see later).

It has been found that during the dry season, copra can be dried to 4 per cent. moisture content and will remain dry and that wetter copra will on very

* Extracted from the records of the Meteorological Branch, Survey Department, S.S. & F.M.S.

(1) Philippine Journal of Science, March 1917. Brill Parker & Yates.

prolonged storage under good conditions continue to dry out to this figure. In the wet season, similarly well-dried copra will, however, reabsorb moisture slowly to between 6 per cent. and 7 per cent. for "case-hardened" copra and even up to about 10 per cent. for copra which has not a protective skin. About 6 per cent. represents the average stable condition for kilndried copra stored in bulk. It would materially assist the welfare of the industry and simplify the handling and marketing of this commodity if this figure were adopted as the standard by all producers.

During transport to Europe, all the copra produced in this country dries further and almost invariably on arrival at its destination the moisture content is between 4 per cent. and 5 per cent.

To allow for moisture loss and possible deterioration of quality in transit, the usual practice is for the shipper to claim a weight allowance of about 5 per cent. whether such a loss occurs or not.

Copra Deterioration.

A copra of satisfactory moisture content, (viz. 6 per cent.), is liable only to the formation of a thin white mould which readily falls off in transit leaving the copra clean and white on arrival in Europe. Copra of higher moisture content produces white, brown, green or heavy black moulds apparently indiscriminately with the development of heat, free acidity, rancid odour and internal darkening of the material. Black mould in particular is indicative of copra with a moisture content in excess of 10 per cent. The factors which determine the development of specific moulds are in course of determination as it is fairly certain that the moisture content is more an agent than a controlling factor.

It is specially interesting to note that the process of decomposition adds moisture to the copra so that when bad copra is stored in ill-ventilated store rooms or transported in leaky boats, the quality may easily become progressively worse and result in a hot, slimey, dark, evil-smelling, matted product of high acidity but with a high oil content (see Table 3 and later).

Two samples of copra were stored for two months in sealed tins with the following results :—

Description.		*Original Moisture per cent.*	*Final Moisture per cent.*	*Description.*
White, crisp	...	4.5	5.4	F.M.S. quality maintained.
White	...	12.1	64.7	Rank smell. Black, congealed and rotten.

While such slimey copra is of no value for export purposes, it is sold locally at a cheap price and commands a ready sale to certain Malayan oil mills. It is

important to explain why such copra contains a high percentage of oil while at the same time heavy losses are incurred during the process of deterioration, both oil and copra being converted to water vapour and gas and lost.

Oil Gradient.

When slices are cut from pieces of coconut meat parallel to the testa or brown skin and the different slices are analysed it is found that an oil gradient exists in the meat which in the case of ungerminated nuts is particularly marked. The figures in Table 2 serve to illustrate this point.

TABLE 2.

Oil Gradient in Coconut Meat.

Nut Selected.	Oil Percentage (dry basis). Slices of equal thickness.					
	1	2	3	4	5	Testa.
Ripe brown nut ...	40.0	64.6	67.2	75.8	73.7	13.8
Ripe (1″ haustorium) ...	52.0	68.2	72.8	76.0	76.4	...
Overripe (4″ haustorium).	...	73.8	70.2	74.5	74.5	...

TABLE 3.

Copra Deterioration. To illustrate the relation between high free fatty acid (f.f.a.) and high oil percentage.

		Good undeteriorated copra.	Insect ridden copra.	Mould and insect ridden.
Malayan Estate Copra	No. of samples ...	16	2	8
	Average oil percentage.	65.8	65.4	66.8
	Average f.f.a. percentage	.1	.2	.8
Straits Native Copra	No. of samples ...	6	7	19
	Average oil percentage.	64.8	65.2	67.0
	Average f.f.a. percentage	.3	1.2	1.6

Thus, when moulds attack the inside face of a piece of copra, it would appear that as the tissue containing the lowest oil percentage is broken down and removed in the form of gas and water vapour the unattacked copra that remains becomes progressively richer in oil. As deterioration progresses (in the absence of insect attack) the average oil percentage therefore increases and figures in excess of 70 per cent. oil for low grade Malayan copra are quite common. Only in very exceptional cases is the percentage of oil lower than 66 per cent. in mouldy Malayan copra, i.e. when copra is uniformly rotten throughout.

During such deterioration free acidity, and the further destruction products of glycerol render the copra sour and evil-smelling and the resulting oil and cattle cake dark and unpalatable.

However, it is important to note that the ether extract includes the free fatty acid so that deteriorated copra does not contain as much neutral oil as analytical results expressed as oil percentage (dry basis) may appear to show. The importance of this observation lies in the fact that the purification of an extracted coconut oil to remove its free acidity yields in large quantities what is known as "dirty soap stock" and in an edible oil factory the disposal of this bye-product is difficult while in the soap factory it can only be used in low grade soaps, because it retains most of the dirt and colour of the oil. This soap stock is not of much value and its removal by caustic soda is expensive.

During deterioration by heat, moulds, or insects, there is a concealed loss of oil and copra constantly proceeding which may be very considerable. It is the producer who suffers from these causes, because the various buyers allow in the price they are able to offer for anticipated depreciation in transit.

That actual loss of oil and copra occurs during deterioration has been shown experimentally in Fiji (2) by exposing copra on a drying "Vata" to the action of air borne moulds. In 14 days it was found that the copra dried to 5 per cent. but that it lost 12.4 per cent. of its anhydrous weight and 8.2 per cent. of its total oil while the free acidity rose from .2 per cent. to 8.5 per cent.

It has been found in Malaya that if bad copra, which has developed a high degree of rancidity, is stored under good conditions of free ventilation, the acidity diminishes while the copra as a whole will become dry and clean and the mould will fall away as dust. Six large samples were stored for three months under excellent conditions and the results are given in Table 4.

It would appear that the drying of the copra arrests further acid formation from the neutral oil while the existing fatty acids are converted into water vapour and gas and removed with a consequent reduction in the f.f.a. content.

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(2) Blackie, Agricultural Journal, Fiji, Vol. 3, 1930, page 78.

TABLE 4.

Effects of Storing Native Copra.

Date of Receipt 28-12-29.

Original Appearance.			Acidity of oil per cent. (as lauric acid.)			Final Appearance.
			30-12-29	28-2-30	18-3-30	
Light brown ...	Mouldy	Superficial insect attack ...	.72	.42	.42	All the copra now dry and mould free but exceedingly insect ridden—originally the samples looked different, now they look similar.
Light brown ...	Mouldy	Superficial insect attack ...	1.72	.43	.22	
Dark brown ...	Very mouldy	Insect-ridden ...	2.48	1.82	1.51	
Dark brown ...	Very mouldy	Insect-ridden ...	3.02	1.21		
Dark brown ...	Very mouldy	Insect-ridden ...	3.12	1.76	0.80	
Dark brown ...	Very mouldy	Insect-ridden ...	3.43	2.15	2.04	
	Average		2.42	1.30	1.12	

Neutral Oil

Fatty acid — Glycerol

Gas and Water Vapour

Glycerol Derivatives
Gas
Water Vapour

Physical Properties.

Apart from its good keeping qualities, well-dried brittle copra is to be preferred because as has been stated by an authority in England, rubbery copra does not press well. When the pressure is applied the oil flows satisfactorily, but at the end of the operation when the pressure is released, the cake tends to suck up the oil again owing to the elasticity of the material. This authority has stated that with such copra it is not possible to reduce the oil below 7 per cent. whereas good friable copra yields a cake with 5 per cent. oil.

Such rubbery copra may be produced from young nuts, and " case hardened " copra with a wet core will also show elastic properties. It is interesting to note that " case-hardened " copra appears to show considerable resistance to mould attack except in the presence of insects which are able to pierce the burnt crust and so expose the wet copra beneath to mould attack.

Size.

If the pieces of copra are too large, the consignment will naturally be very bulky, and the best practice is to chop the half nuts into four pieces. The manufacturers object to copra of large size on the grounds that it takes longer to charge the machinery and more storage room is required owing to the bulkiness of the material.

At this point some reference might be made to the advantages of the baling of chopped copra. To date, one firm in this country has exported during the past year 500 tons of " F.M.S." copra in baled form to Europe with entirely satisfactory results. An article on this subject giving the experimental results obtained has already been published and further experimental work is proceeding to explore the possibilities of the baling of the lowest grade of copra available on the Singapore market.

It should be noted (a) that copra can be compressed at a pressure of 1.5 cwts. per square inch without loss of oil either during compression or subsequent strong and shipment. (b) That the " broken stowage " is reduced, e.g. 20 cwts. of baled copra occupies only the same cargo space as 12 cwts. of sacked copra. Local transport and shipping freight charges can accordingly be reduced. (c) The bales stack squarely leaving straight channels for air movement through the

stack. (d) The bales, which are 2 cwts. in weight, can be easily checked and are of convenient size and shape. (e) There is no evidence that "F.M.S." copra deteriorates more in transit in baled form than in sacks, nor is there any loss of oil.

If the material is much broken up so that there are " smalls " the dealer objects because :—

(a) this allows the careless or deliberate inclusion of foreign matter, (grave exception is taken to sand, nails, etc. which can do great damage to machinery.)

(b) it makes sorting of " mixed " copra into " F.M." and " F.M.S." grades difficult.

(c) much broken up copra exposes a large surface to mould and insect attack and the smallest pieces are gradually converted to a grey fibrous dust which gives the material a dirty appearance. The small pieces are also readily lost in handling.

(d) the cattle cake derived from such copra will be sour and darker than the best.

The production of " smalls " should, therefore, be avoided and it is recommended that, where the meat must be extracted wet from the shell in the field, as far as possible only fully-ripe nuts should be harvested. The meat of unripe nuts is very adherent to the shell, while the thin meat of very over-ripe nuts is inclined to break. On the other hand, where the halved nuts are transported to the kiln and are subjected to semi-drying, the half pieces of meat readily fall out of the shell. When the fully dried copra is subsequently chopped to reduce the bulk, care must be taken to obtain pieces of even size. It is doubtful, however, if this practice is to be recommended as a fresh wet surface is thereby exposed to mould attack. It would be better to chop the copra when half dry as it comes from the shell and then dry and seal the cut surfaces.

Thickness.

As far as possible, only fully ripe brown nuts should be used for the production of copra because such nuts produce the greatest thickness of dry meat. The practice of picking unripe nuts in order to take advantage of a favourable market, or to obtain a speedier cash return, or because crop collection is leased out, or to anticipate theft, is well known.

Oil Content.

It has been shewn that bad copra can contain a high percentage oil content i.e. high ether extract. At the same time the yield of neutral oil will be small and it will be of low quality on account of extraction difficulties. A large amount of soap stock has to be removed to purify the oil, while much of the original colour and odour is still retained in the oil even after refining.

* Cooke, Malayan Agricultural Journal, June, 1930.

The ultimate objective is to produce a copra equivalent in physical condition, appearance and oil content to the " F.M.S." Ceylon product. In Ceylon a white copra of high oil content is regularly produced, and receives special preference in the London market. The related questions of cultivation and soil improverishment are being investigated, while correct nut harvesting and possible oil loss during copra preparation are also being studied with a view to correcting the alleged decline in the oil content of good quality Malayan copra during the last ten years.

Abstracts.

THE FOURTH WORLD'S POULTRY CONGRESS.

The Congress was held at the Crystal Palace, London, from July 22nd. to 30th., 1930, and was attended by over sixty delegates. Mr. T. D. Marsh, Assistant Agriculturist, represented the Federated Malay States. In conjunction with the congress was held an international exhibition of poultry, pigeons and rabbits. Upwards of 7,000 head of poultry were on view from all parts of the world. The British exhibits were the most numerous, although 1,500 birds were sent from the American continent.

Mr. Marsh has prepared a report on the Congress with numerous interesting comments and the following points are drawn from this report.

Dealing with the Exhibition, he points out that the event provided an unique opportunity for breeders to acquire fresh unrelated stock as practically all exhibits were for sale.

It is of interest to note that the exhibition was essentially one of utility poultry. The utility type is being selected to differ from what is known as the true exhibition type. The exhibition bird has had its value in the past and will no doubt also have in the future in providing a fixed type of foundation stock for the production by selection of pure-bred utility poultry. At the present time, the exhibition stock is being exploited for the production of either pure-bred or cross-bred types or sex-linked birds.

The appliances exhibited in the trade section were very comprehensive. Amongst the exhibits were mammoth incubators, in which each separate machine will hold 16,000 eggs, which are heated and ventilated by machinery.

Battery brooders of many designs, but all comprising a series of superimposed trays up to about six, and capable of holding hundreds of chicks, from the time they are hatched until they are several weeks old, were shown. These machines disregard successfully all previous methods of rearing poultry, which included exercise, sunshine and the open air; the success of the system is due mainly to correct feeding with a supply of sufficient minerals and vitamins.

Poultry houses of many different patterns and sizes were shown, which provide for correct ventilation and lighting. A recent innovation is "slatted" floors in which batons, square or rectangular in section, about ⅝ inch wide are used with a space between of about 1¼ inch; a wooden floor about six inches below the slatted floor is built to catch "droppings". These houses are always clean, as the manure can easily be raked out at one side of the house.

Machines that caused interest were egg-graders and a plucking machine, British made, which, although it will not pluck the birds completely, should be a great saver of labour in large establishments.

A very large number of papers were presented at the Congress sessions and it is impossible to do justice to them in these brief notes. In relation to Breeding and Incubation, there were 29 papers. The other groups of papers were:—

Nutrition and Rearing; Diseases and their control; Economics, including Marketing; Education and General; and Rabbits.

Much valuable information was given in the 25 papers concerning nutrition and rearing, some of which might be applied to conditions in Malaya and in the tropics. It is probable that mixed poultry food could be imported from England which would be more economical to feed and less likely to carry parasites and disease than those purchased locally; that is, for an established poultry farm where large quantities were required.

The series of thirty-two papers on diseases and their control should provide a valuable indication to the nature of the disease known to the Malays as " Bulan Tujoh Sakit," which is very contagious and destroys thousands of fowls annually. It is possible that the Malayan disease is one of the known diseases of poultry: a comparison of the symptoms with those described in the papers would possibly identify the disease and if not, the remedial measures and preventatives would suggest methods that would reduce the annual mortality of Malayan fowls.

Research work on fowl diseases is being conducted at the Veterinary Institute, Buitenzorg, Java, by Dr. W. K. Picard. The results of his work on " Pseudo fowl pest " may show on examination that the symptoms of this disease are similar to those of Malayan fowls.

Amongst the educational papers one which should be of interest to Malaya is that given by the poultry expert to the Government of the United Provinces of India on poultry feeding in the tropics. It states results achieved by a trial and error method which is not very scientific, but which gives some experience gained in India with European and Indian stock.

It will be seen that the Congress papers cover a very wide field of research and are deserving of close attention.

TRANSPORT OF MANGOES AND POMELOES BY SEA.

Reference has been made in previous numbers of this Journal to various aspects concerning the transport of fresh fruit by sea.* The recent publication in Dutch of two Bulletins by Ir. W. Spoon † carries our knowledge of this subject a step further.

The first bulletin describes experiments made in sending the fruit of four varieties of *Mangifera indica* Linn from Java to Holland. The fruit ripens in Java towards the end of the dry season; in the western part of the island somewhat earlier than in the eastern part, during the months September to November. The voyage takes 5 to 6 weeks and arrivals in Europe would therefore supplement arrivals of shipments from South Africa which are made in January and February.

Not all varieties of mangoes keep equally well, especially after storage in Europe at normal temperatures; therefore quick sale is generally imperative. Great care should be taken not to bruise the fruit during picking and packing as bruised spots quickly deteriorate after the fruit has left the refrigerating room. The optimum temperature seems to be 3°C.

The fruit was packed in crates stuffed with coconut fibre; when packed in flat crates containing one layer only, it arrived in better condition. The fruits should be picked from the tree while still hard and green; some fruit ripens during the voyage, others quickly after arrival. Very unripe fruit that has been in cold storage for over 40 days appears to be no longer able to ripen.

The large-size "golek" variety appears to have the best keeping qualities; the "gedong"—(which shipped from Batavia, has the advantage of a week's difference in the length of voyage)—comes a close second; while the "Madu" and "arum-Manis" varieties are more delicate.

The percentage of saleable fruit unpacked differed greatly and probably depends greatly on the amount of care give to picking and packing and on the length of the voyage. The financial results were not unsatisfactory and with sufficient experience a regular remunerative trade might be built up. The wholesale price in the London market is three pence each for the South African mangoes and the first cost of the fruit should consequently not exceed one penny each off the tree.

The second pamphlet by this author described the results of the shipping of a few parcels of pomelo from Deli (Sumatra) and from Batavia (Java) to the Netherlands.

On one occasion the fruit was shipped in the hold resulting in 20 per cent. of the fruit being unfit for sale on arrival in Europe. On all other occasions, the

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* Malayan Agricultural Journal, Vol. XVIII, p. 106, "Experimental Consignments of Pineapples"; and p. 350 "The Transport of Fresh Fruit by Sea."

† Nos. 50 and 51 of the Division Commercial Museum of the Royal Society Colonial Institute of the Netherlands.

fruit was shipped in the refrigerating room at temperatures of 2°C to 4°C and there was practically no loss. The pomelo keeps very well in cold storage and ripens very well afterwards. Even at the 25 per cent. higher rate of freight for cold storage it pays better to ship in this way.

The variety of *Citrus maxima* Merr = syn. *C. decumana* Linn. best suited for the European market, is the more succulent variety "jeruk delima." The fruit of this variety is large, 6 to 8 inches in diameter, and heavy—weighing 2 to 3½ pounds. It is packed in round crates of split bamboo stuffed with coconut fibre, each containing 7 fruits. Smaller varieties are packed in wooden crates of the size and shape of kerosene tin cases, containing 18 to 21 fruits.

The first cost of the fruit is three to four pence each off the tree, according to size; the landed cost is respectively seven to nine pence.

The fruit has been examined for vitamin contents in the Laboratory of the Netherlands Institute for the Nutrition of the Nation at Amsterdam. A full report of the procedure and findings is given. The conclusion drawn is that the fruit contains the anti-scorbutic vitamin C in a sufficient quality to make it suitable as an anti-scorbutic remedy, though it does not contain as much of this vitamin as does lemon juice.

The Laboratory of the Public Health Service at Weltevreden also ranks the pomelo among the fruits, containing "considerable quantities" of the anti-xerophthalmic vitamin A and "large quantities" of the anti-scorbutic vitamin C.

The voyage in cold storage consequently does not seem to have affected detrimentally this property of the fruit.

L. A. J. R.

Reviews.

World Agricultural Tractor Trial 1930.

Official Report.

109 p.p and numerous illustrations. Oxford: Hall The Printer, Ltd.

Price one shilling.

This is the official report on tests and specifications of machines that were entered for trials in 1930 held under the auspices of the Royal Agricultural Society of England in conjunction with the Institute of Agricultural Engineering, University of Oxford.

The first section gives a full description of the methods by which the tests were conducted. A report of the general tests on tractors follows, together with a brief report of the Road Test. The tests of Market Garden cultivators are next dealt with. In the final section an illustration and specification of each machine is given, together with a brief extract from the results of its tests.

As the Foreword points out, " the object of these tests and of the Trials generally was not necessarily to determine which tractor is the best in its class, but simply to shew exactly what each machine was capable of doing under normal conditions."

In view of the growing importance of mechanised farming, this small volume is of value to those who wish to keep themselves informed on the improvements that are constantly being effected in this direction, or who contemplate its application to their own particular agricultural pursuits.

D. H. G.

The Application of Science to Crop-Production.

BY

A AND G. L. C. HOWARD,

81 pp., 12 pls., 7 figs. Humphrey Milford, Oxford University Press, B.I. Building, Nicol Road, Bombal. 1929, 10 shillings.

The Authors record their opinions on the application of botanical science to crop-production in India. An opportunity of giving practical expression to their views was afforded by the founding of the Institute of Plant Industry, Indore, of which the senior author is the Director.

Of the seven chapters of this book, the first two, viz: The Genesis of the Indore Experiment and The Institute of Plant Industry, Indore, with the

final two chapters on the maintenance of liaison between the Institute and its supporters and the organisation of research deal, not merely with the particular problems that faced the writers, but with the general question of policy regarding the organisation of agricultural research. The intermediate chapters are concerned with the investigations of the Institute in connection mainly with cotton.

The Chapter dealing with the Institute lays down a number of principles that should be observed by those whose duty it is to organise institutions for agricultural investigations. The system of research centres, financed, in part at least, by benefactors of various kinds is favoured in place of institutions financed and worked by Government, as the former system affords ample scope for rapid development and tends to make the bond between the research workers and the actual cultivator much closer and more intimate. The Institute is strongly supported financially by the Indian Central Cotton Committee. The parallel in Malaya is the Rubber Research Institute, financed by a cess on rubber. The point of view is that a research institute should be strongly supported financially by the industry that it endeavours to benefit.

Throughout the book the line of though has been : firstly, that the scientific and agricultural aspects of work on crop production should be as closely coordinated as possible. Secondly, that close liaison should be maintained between the Institute and its supporters; thirdly, that by means of demonstration farms and by organized visits of cultivators to the Institute the results achieved at the Institute may find wider application.

It is claimed that research and demonstration should be the only two branches recognised; that each should be considered of equal importance and of equal dignity; but that they should be distinct, not overlapping but working in concert.

The solution of the difficulties of organisation of agricultural research is thus found by giving up the artificial division of the subject, into long-range and local problems and substituting the more natural one, of research and demonstration.

The authors conclude that "the ideal system of conducting agricultural research in the Empire seems to lie in the simplification rather than in the elaboration of the organisation. All that is necessary appears to be to provide each region with a research institute of its own." From this point the efforts should be concentrated on obtaining the best men and providing them with the means necessary to carry out their ideas. "Any attempt to overstrain system of organisation in the hope that they may replace competent investigators can only end in failure. In research, the man is everything; the organisation is a minor matter."

Since this book was reviewed, the death has occurred of the second author, Mrs. G. L. C. Howard.

This death has brought to a premature end a notable career. Mrs. Howard's 25 years of research in India, mainly on plant-breeding and on the methods of applying science to crop production, provides a monument to her notable career. Her demise will be regretted not only by her immediate co-workers and friends,

but by scientists throughout the world, who have watched her brilliant career with interest and appreciated her valuable contributions to science.

D. H. G.

First Annual Report of the Executive Council of the Imperial Agricultural Bureaux.

This report reviews the activities of the Council for the year 1st. April, 1929, to 31st March, 1930.

After reference to the inception of the scheme, the report states the financial position, the details of which are given in an Appendix, and proceeds with an account of the progress made during the year under review.

A detailed account of the eight Bureaux was given in the *Malayan Agricultural Journal* of February 1930, so that reiteration is unnecessary. It will be remembered that the eight Bureaux are :—Animal Nutrition, Animal Genetics, Fruit Production, Soil Science, Plant Genetics (Herbage Plants), Agricultural Parasitology, Animal Health and Plant Genetics (for crops other than Herbage).

These eight Bureaux have been fully organised and it is expected that further increases in staff will be very few.

The officers of the Bureaux have been in consultation with the official correspondents resident in various portions of the Empire regarding the work and development of the Bureaux.

The year was necessarily one of organisation, although several of the Bureaux have already commenced the distribution of information on their particular branches of agricultural science.

The task of the Bureaux is not research work, but the collection and dissemination of information on research work accomplished or in progress, and the promotion of co-operative effort in the solution of common diffiuclties by putting research workers in touch with each other and through the enquiries that reach them, of indicating the problems demanding investigation.

The Council and the Directors of the Bureaux lay special stress on promoting direct contacts between officers of the Bureaux and research workers overseas.

The question of study leave has been considered. In this connection the present Directors of the Bureaux have given advice when consulted. The Bureaux are in touch with both Empire and Foreign Research Institutions and are prepared to advise regarding centres at which study leave might be spent and to endeavour to facilitate arrangements for such studies.

The report is an ungarnished record of the work that has been done and put in hand. It is not to be expected that any spectacular results could have been achieved in the short period that the Bureaux have functioned, but it would appear that developments are being made on lines which should prove of value to workers overseas to further the advance of scientific research in the Empire.

D. H. G.

Departmental.

FROM THE DISTRICTS.

The Weather.

The weather throughout the month was in general hot and dry with occasional heavy showers in some localities.

Remarks on Crops.

Rubber.—The local prices given for rubber from small holdings again declined, being $12 to $14.50 a picul for smoked sheet and $9 to $12 for unsmoked sheet.

Wintering commenced generally throughout the country during the month and in some districts was well advanced at its close.

In Pahang West a considerable number of Chinese owners of rubber discontinued tapping for a period of 7 to 10 days on either side of the Chinese New Year holiday. In the Negri Sembilan, on the other hand, tapping was resumed on many areas of small holdings on which it had been stopped for several months.

The dry weather had the usual effect of materially reducing the prevalence of Mouldy Rot disease in many of the infected localities. It was still prevalent, however, in the sub-District of Tanjong Malim and in parts of Selangor. Sanction was obtained to employ three additional temporary Malay Inspecting Officers in these more heavily infected Districts and the existing Inspectors gave special attention to the demonstration and enforcing of control measures.

Padi.—General information is given elsewhere in this number. In Pekan District about 1,070 acres of padi are reported to have been destroyed by the floods at the end of December and beginning of January last. A supply of 600 gantangs of the five months padi, Radin Siak, was sent to Pekan from Malacca for use as seed and a further supply was ordered.

Measurements of yields from trial plots of pedigree strains of padi were in progress in many parts of the country. Among results already recorded mention may be made of a yield of 800 gantangs (gallons) per acre from Radin 13 in Semantan Mukim of Temerloh District and 560 gantangs from Seraup Kechil No. 36 at Rantau Panjang in Pahang; while the latter strain at Perankap in Batang Padang District gave 450 gantangs per acre as compared with 250 to 300 gantangs obtained from local padi.

In Selangor and in parts of Pahang steps have been taken to alter the padi planting dates in the coming season, as it was found in the past season that planting was fixed too early, so that this operation was handicapped by dry weather and the harvest occurred during the normal rainy season instead of the drier months of February and March.

The padi fly (*Leptocorisa acuta*) M. Pianggang, occurred in large numbers on "dry" padi in the coastal Districts of Selangor. Stem borers and sucking insects did considerable damage to the later maturing padi in Kedah and were the subject of an investigation by the Assistant Entomologist, Mr. Miller.

Coconuts.—A severe outbreak of the nettle caterpillar, *Setora nitens*, occurred on an estate in Perak South at the beginning of the month. Vigorous efforts resulted in its control. At the end of the month only a very few young caterpillars could be found, most of the new generation having been killed by their insect parasites.

Coffee.—In Perak South crops were being harvested and prepared for the local market. In Temerloh District of Pahang the price of coffee was only $15 to $16 per picul.

Tea.—Arrangements have been made to conduct small scale trials of manures on Chinese small holdings planted with tea in Selangor.

Fruit.—Good crops of durians, guava and limes were harvested in Perak South. In the Negri Sembilan there were fairly large supplies of durians, mangosteens, langsat and rambutan, but towards the end of the month most of the crop had been harvested and local prices were rising. At the same time, supplies of rambai were beginning to reach the markets in fair quantities. In Pahang the fruit crops were variable. Langsat, pulasan, rambutan, mangosteen, rambai, duku and durian fruited heavily in Pekan District. In Raub and Bentong Districts fair crops of these fruits were produced, but in Temerloh District the crops of durian, rambutan and langsat were poor.

Vegetables.—During the month 5,168 piculs of vegetables were exported from Kinta District of Perak and were sent to all the principal railway stations between Alor Star in Kedah and Singapore. The Agricultural Field Officer, Negri Sembilan, reported a considerable fall in the price of vegetables, eggs and poultry in many areas and attributed it to the lower purchasing power of the community and not to larger supplies.

Notes on Demonstration Stations and Padi Test Plots.

Telok Chengkai Padi Experiment Station, Kedah.—Harvesting was in progress throughout the month. Ears of each pedigree strain were cut for seed and a large number of ears were selected in the local varieties grown to start line breeding during the coming season.

Kuala Kangsar Agricultural Station.—The old orange trees were removed, except for a few carrying marcots. The young trees were bearing a fair crop which is expected to ripen in April. Many of the vegetable beds were planted and the young plants made promising growth. Tobacco seed obtained from Kedah was sown.

Talang Padi Station.—The pedigree strains in the test plots were reaped, but the local padi for comparison, being of longer maturation period, was not quite ripe. The manurial plots were nearly ready for harvest.

Lenggong Padi Test Plot.—Reaping was in progress at the end of the month, but unfortunately, storms had caused lodging of both the pedigree strains and the local padi.

Tapah Agricultural Station.—The work of clearing the site was commenced and a lay-out plan was under consideration.

Dong Padi Test Station, Pahang.—Harvest was completed and the crop was expected to be even better than that of last year. Seed for the coming season's planting will be supplied to the Temerloh and Pekan Plots where the crops were almost entirely destroyed by floods.

Temerloh Padi Test Plot, Pahang.—Work was commenced on the new five acre site which is being laid out on the standard plan now adopted by the Department for these Test Plots.

Pekan Agricultural Station, Pahang.—Rambutan, pulasan and duku were planted; the vegetable plots were prepared for planting.

Pulau Gadong Padi Experiment Station, Malacca.—Harvesting was completed together with the attendant winnowing and measuring of yields. Work in connection with selection continued throughout the month. The stilling tank for the pumping installation was built.

Alor Gajah Padi Test Plot, Malacca.—Harvesting was completed and the crops from the different plots were winnowed, dried and measured.

Sungei Udang Agricultural Station, Malacca.—Good progress was made with the development of this new station.

Plants Distributed.

Small supplies of seed of three pedigree strains of padi were sent from Malacca for trial in Southern Siam. Seeds of various vegetables, including tomato, and of two species of green manure plants were distributed from the Pekan Station.

School Gardens.

All the schools were closed during the fasting month, and in some Districts for the subsequent padi harvest. A few were visited to advise on the reopening of the gardens after the holiday.

Rat Destruction.

In Krian only 2,046 rat tails were padi for. The figures for Province Wellesley were not available when this report was written. In Malacca rewards were paid for 25,930 tails, the great majority of the rats being caught by digging them out of holes in the dry bunds of the padi fields. The Malays in some parts of Malacca are now taking considerable interest in the destruction of rats. In Batang Padang District of Perak trapping and poisoning were continued and bush adjoining padi land was being cleared in order to remove shelter for rats. In Lower Perak District considerable damage was done to padi by rats and control measures received insufficient attention.

DEPARTMENTAL NOTES.

Tours of the Director.

The Director of Agriculture S.S. and F.M.S. toured the principal Western padi growing areas from January 31st. to February 6th. visiting Kedah, Penang, Province Wellesley, Krian, Taiping, Kuala Kangsar and Upper Perak. The work of the padi experimental stations and sites for certain new agricultural stations were inspected. Points of interest were discussed with administrative officers and with field officers of the Department.

On February 14th. the Director visited Fraser's Hill in connection with the work of the new farm and dairy. He conferred with the Senior Health Officers, Pahang and Selangor, and the Executive Engineer, Raub, concerning various details connected with the undertaking.

Cameron's Highlands was visited on February 20th. when the Director attended a meeting of the Cameron's Highlands Development Committee and inspected the Plantation.

Demonstration at Serdang.

A demonstration was held on February 13th. at the Government Experimental Plantation, Serdang, and was attended by a party of Chinese from Kuala Lumpur and Bentong, Pahang.

Although the tea factory was not working during the visit, the various processes were explained in detail. The general nursery and tea areas were inspected and the details of management explained and discussed.

The cultivation of oil palm and manufacture of oil was followed with much interest.

Much time was spent in the fruit nursery where special attention was devoted to vegetative propagation.

The visit to the stock farm aroused the usual interest, the Middle White pigs being especially admired.

Leave.

Mr. A. Sharples, Government Mycologist, returned from leave of absence on 15th. February, 1931.

From the date of his return from leave, Mr. Sharples has been seconded to the Rubber Research Institute of Malaya where he assumes the post of Head of the Pathological Division.

Mr. G. E. Mann, M.C., Vice-Principal, School of Agriculture, Malaya returned from leave of absence on 19th. February, 1931.

Statistical.

MARKET PRICES.

February, 1931.

Rubber.—The average price of rubber in Singapore was 11.9 cents per lb. against 12.8 cents per lb. in January, 1931. The highest price quoted was 12 cents per lb., the lowest 11 3/8 cents per lb. The average London price for the month was 3.8d. against 4.1d. per lb. for the previous month. The highest price was 3 7/8. per lb., the lowest 3 5/8d. per lb.

Palm Oil.—The price of palm oil in London is £16.10.0 to £16.15.0 F.O.B. according to position. It is stated that the price has been maintained on account of America buying in fairly large quantities. It is understood that they are using palm oil for the manufacture of margarine.

Copra.—The Singapore market for copra has been steady with moderate business passing. Prices at the end of the month shewed an upward tendency. Average prices were: Sundried, $5.67 per picul; Mixed, $5.33 per picul; Cake, $1.50 per picul. Corresponding prices in January were: $5.72. $5.41, $1.75 per picul.

Pineapples.—There is a moderate demand for ready, but buyers have withdrawn for distant delivery at lower prices. The tendency continues downwards. Average Singapore prices in February were 1½ lb. cubes, $3.53 per case; 1½ lb. sliced, flat, $3.27 per case; 1½ lb. tall, $3.63 per case.

Tapioca.—Singapore prices have been dull with a tendency towards lower prices. Average prices for the month were: Flake, fair, $4.07; Pearl, seed, $5.06 Pearl, medium, $6—all per picul. These prices shew a drop of 14 cents per picul in each case below the average prices ruling in January.

Sago.—Flour—Sarawak fair dropped to $2.40 per picul, but later recovered to $2.60 on the settlement of the Lancashire cotton dispute which created a better sentiment in the market. The price again dropped at the end of the month to $2.35 per picul. The average price for the month was $2.48 per picul. Pearl —small, fair, fell from $6.25 per picul to $6 per picul: Average price for the month $6.06 per picul.

Rice.—Average Singapore prices for February were: Siam No. 2, $175; Saigon No. 1, $161; Rangoon No. 1, $148—all per coyan—compared with $186; $176; $156 per coyan in January.

Gambier.—Market featureless, Singapore average prices in February were: block, $9.60; cube, No. 1, $15 per picul compared with average prices for January of $9.50 and $15 respectively.

Pepper.—In Singapore a moderate business continues to pass with a steady market. Demand is fair and the undertone is good. Average prices for the month were: Singapore, black, $21.06; Singapore, white, $36.88; Muntok, white,

$38.12 per picul compared with the January averages of $20.87; $36; $37.06 per picul respectively.

Cloves.—Average Singapore prices: Zanzibar, $62 per picul; Amboina $59 per picul compared with $62.25 and $60.25 per picul in January.

Nutmegs.—Average prices for February; 110 per lb. $25 per picul against $23.88 in January; 80 per lb. $29.75 per picul.

Mace.—Average Singapore prices: Siouw, $92.50 per picul; Amboina, $59.50 per picul.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports for February, and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd.

1 picul = 133 1/3 lbs. 1 coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

MARKETING MINOR CROPS.

The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Planters of some of the minor agricultural products frequently experience difficulty in getting in touch with buyers. It is thought that in such cases the assistance of the Department may be of particular value to producers.

Similar assistance also comes within the scope of the Malayan Information Agency, 57 Charing Cross, London, S.W.1. The Agency is in close touch with firms in the United Kingdom dealing with every kind of agricultural product from the tropics and in constant communication with the Imperial Institute, the Department of Overseas Trade and the Empire Marketing Board. The services of the Commercial Member of the Advisory Board of the Agency are also of great value in this connection.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1930	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES:—																		
Federated Malay States	...	12,260	15,396	12,268	12,268	10,029	10,029	Nil	4	Nil	4	14,014	7,697	14,014	7,697	12,877	15,369	...
Johore	...	2,207	4,639	3,741	3,741	4,229	4,229	Nil	Nil	Nil	Nil	629	7,129	629	7,129	2,257	4,801	...
Kedah	...	435	2,614	2,496	2,496	1,369	1,369	Nil	Nil	Nil	Nil	701	3,079	701	3,079	463	2,671	...
Perlis	...	11	10	8	8	16	16	Nil	Nil	Nil	Nil	Nil	25	Nil	25	10	10	...
Kelantan ...	...	114	97	195	195	460	460	2	Nil	2	Nil	55	524	55	524	188	101	...
Trengganu* ...	..	55	50	52	52	26	26	Nil	Nil	Nil	Nil	Nil	78	Nil	78	55	50	...
Total Malay States	...	15,082	22,806	18,760	18,760	16,129	16,129	2	4	2	4	15,399	18,532	15,399	18,532	15,850	23,002	...
STRAITS SETTLEMENTS																		
Malacca ...	...	3,241	1,905	1,212	1,212			Nil		Nil		5,179		5,179		3,365	1,664	...
Province Wellesley	...	130	660	510	510	(2)	(2)	Nil		Nil						133	663	...
Dindings ...	...	233	119	105	105	2,000	2,000	Nil	18,528	Nil	18,528	5,638	Nil	5,638	Nil	167	128	...
Penang	1,710	4,551	12	12	12			846		846						5,244	14	1,364
Singapore ...	3,859	31,455	335	193	193			8,143		8,143		15,363		15363		33,293	299	4,740
Total Straits Settlements	5.569	39,610	3.031	2.032	2,032	2,000	2,000	8,989	18,528	8.989	18,528	26,180	Nil	26.180	Nil	42,202	2,768	6,104
TOTAL MALAYA	5.569	54,692	25,837	20.792	20,792	18,129	18,129	8,991	18,532	8,991	18,532	41,579	18,532	41,579	18,532	58,052	25,770	6,104

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	9,581	19,128	3,589	2,783	862	35,893
Crepe	655	10,621	943	665	229	13,113
Unsmoked sheet	1,555	3,544	712	217	696	8,330
Scrap and lump	1,136				470	
Total all Grades	12,877	33,293	5,244	3,665	2,257	57,336

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	25,752	25,752
Penang ...	10,115	10,115
Port Swettenham.	4,763	4,763
Malacca ...	949	949
MALAYA ...	41,579	41,579

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	33,075	33,075
MALAYA ...	33,075	33,075

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, the figure is an estimate based on the average found for the year 1930. Purchases by dealers S.S. from estates of less than 100 acres during the month amounted to 2,630 tons.

3. Dealer' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with the omission of certain explanatory notes, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on February, 26, 1931.

GENERAL RICE SUMMARY

January, 1931.

Malaya.—69,000 tons of rice were imported and 18,000 tons exported during January 1931, compared with 73,000 and 19,000 tons respectively in January 1930. Of this total 56 per cent. of imports was from Siam, 39 per cent. from Burma, 4 per cent. from French Indo-China and 1 per cent. from other countries.

The average declared trade value of imports of rice into Malaya during January, 1931 was $4.94 per picul, compared with $5.27 in December, 1930. The average value per picul in 1930 was $6.52 compared with $7.23 in 1929.

The retail market prices in cents per gantang (Imperial gallon) in January were as follows:—Singapore 37, Penang 44, Malacca 38 compared with 44, 48 and 41 respectively in December, 1930. The average retail prices for 1930 were Singapore 50, Penang 52, Malacca 50.

Malayan padi reports for January shew that there are 97,992 acres of padi land in Perak, of which 80,855 acres, or 83 per cent. is at present under the crop. The padi in the main area —Krian—is not yet mature.

In Selangor, 23,236 acres of padi land exist, about 84 per cent. of which has been planted. Harvesting is proceeding on most of this area.

The area of padi land in Negri Sembilan is 36,672 acres of which 30,182 (82 per cent.) has been planted. Harvesting is in progress.

Reports from Pahang West, which has about 27,749 acres of padi land of which about three-quarters is planted, state that harvesting has either been completed or is in progress.

The Straits Settlements figures are as follows:—

Malacca: 32,615 acres of padi land of which 28,876 acres are planted.

Province Wellesley: 33,748 acres of padi land of which 32,342 acres are planted.

Dindings: 962 acres of padi land of which 782 are planted.

Penang: 4,000 acres of padi land of which 3,000 acres are planted.

Harvesting is proceeding in most parts of Province Wellesley and Penang.

Kedah has 210,040 acres of padi land. No returns are at present available of the area planted. Harvesting is in progress in most districts.

The Perlis harvesting is almost completed. Of the 38,480 acres of padi land in the State 35,750 acres (93 per cent.) has been planted this season.

India:—The total foreign exports of milled rice January to November, 1930 inclusive were 2,478,000 tons.

The fourth provincial forecast of the Burma rice crop for 1930-31 gives the area likely to mature at 12,509,600 acres, being 93,300 acres more than the final figures for the previous year. The estimated outturn amounts to 7,630,000 tons of rice.

The Burma export of rice and rice products from January 1 to December 27, 1930 was 3,421,574 tons as compared with 2,949,063 tons for the same period of 1929, or an increase of 16 per cent.

Average quotations at Rangoon for white rice of 100 baskets of 75 lbs. each between November 26 and December 17 were :—Big Mills Specials Rs. 230; Small Mills Specials Rs. 245 compared with 380 and 411 respectively for the same period of the previous year.

Japan :—A press report from Tokyo (January 22, 1931) states that the actual yield for 1930 has been estimated at 9,380,000 tons, an increase of 1,027,000 tons or 12.3 per cent. as compared with 1929, making a surplus of 1,543,000 tons of which 701,000 tons is being reserved by the government subsidy for next season; the balance (842,000 tons) being available for export. It is not clear whether these figures refer to milled rice or rice in the husk (padi), 100 units of padi being equivalent to 63 units of rice and rice products.

Siam :—According to the second official forecast (*Bangkok Times*, January 19, 1931) the area under padi in the seven main exporting circles at the end of November, 1930 was estimated at 4,592,000 acres, the area damaged at 480,000 acres or 10.5 per cent. and the yield 2,940,000 tons (rice), from which it is estimated that 1,750,000 tons will be available for export.

Java, Madura and Netherlands East Indies :—The position of the crop at the end of December, 1930 (*Korti Berichten*, January 1931) was as follows :—Wet padi total 9,616,000 acres, being 260,000 acres greater than in 1929. Of this, 7,557,000 acres have been harvested, 235,000 acres damaged and 1,824,000 is standing. Dry padi total 2,296,000 acres of which 1,188,000 acres have been harvested.

Imports into the Netherlands East Indies in 1930 amounted to 596,000 tons, being 101,000 less than in 1929.

French Indo-China :—In 1930, entries of padi into the port of Cholon amounted to 1,159,000 metric tons, while exports of rice from Saigon for this period were 1,058,000 tons.

H.B.M. Consul-General at Saigon reports for the month of December 1930 as follows :—The rice exported in 1930 was about 198,450 tons less than in 1929. It is calculated that some 200,000 tons of the old crop remains unexported. The crop in 1930 is good and it may be assumed that the exportable surplus will be 1,500,000 tons; this, together with what remains of the 1929 surplus makes some 1,700,000 tons available for export from Saigon during 1931. Tonkin has also some 500,000 tons available for export.

Ceylon :—Imports for 1930 amounted to 463,000 tons of which 319,000 were from Burma and 116,000 tons from British India. The imports were 6,000 tons greater in 1929.

Europe :—According to the London Rice Brokers' Association Weekly Circular dated December 18, 1930, 692,000 tons of rice were shipped from the East to Europe during the period January 1 to December 18, 1930, being a decrease of 52,000 tons over that of the previous year. Of these total ship-

ments 438,000 tons were from Burma, 212,000 tons from Saigon and 25,000 tons from Siam.

The Levant imported 20,000 tons and the West Indies and America 195,000 tons from the East from January 1 to November 14, 1930. The Levant shipments showed a decrease of 8,000 tons while the shipments to the West Indies and America increased by 16,000 tons over the previous year.

The above summary is abstracted from the General Rice summary for January prepared by the Registrar-General of Statistics, S.S. and F.M.S., and from statistical information concerning Malayan rice cultivation and production obtained by the Department of Agriculture, S.S. and F.M.S. The Department can only accept responsibility for the figures concerning local rice production.

One gantang (Imperial gallon) of rice weighs about 8 lbs. one picul=133.3 lbs.

The currency of Malaya is Straits Settlement currency $1=two shilling and four pence.

METEOROLOGICAL SUMMARY, MALAYA. JANUARY, 1931.

Locality	Air Temperature in degrees Fahrenheit — Means of A. Max.	B. Min.	Mean of A and B	Absolute Extremes — Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature — At 1 foot	At 4 feet	Rainfall — Total		Most in a day — Amt.	Number of days — Precipitation* .01 in or more	Precipitation, .04 in or more	Thunder-storm	Thunder heard	Fog morning obs.	Gale force 8 or more	Bright Sunshine — Total	Daily Mean	Per cent	Length of Day
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.							hr.	hr.	%	hr.
Railway Hill, Kuala Lumpur, Selangor ...	89.3	72.6	80.9	95	70	76	74	82.9	83.4	8.15	207.0	2.88	22	19	...	8	3		155.30	5.01	42	12.0
Bukit Jeram, Selangor ...	87.5	73.1	80.3	91	70	77	75	83.7	85.3	10.54	267.7	2.38	21	18	2	19	6		188.90	6.09	51	12.0
Sitiawan, Perak ...	88.7	73.3	81.0	92	70	83	75	83.3	83.7	13.20	335.3	2.53	21	19	7	24	1		191.00	6.16	...	...
Kroh, Perak ...	86.1	68.9	77.5	92	62	79	72	78.0	80.5	3.53	89.67	0.77	10	11	...	2	1		194.15	6.26	...	...
Temerloh, Pahang ...	84.7	72.3	78.5	91	69	73	74	81.8	83.2	17.69	449.3	4.29	18	16	...	4	8		151.05	4.87	41	11.9
Kuala Lipis, Pahang ...	85.2	71.3	78.3	90	67	74	73	81.3	82.0	13.34	338.9	2.46	20	19	...	4	12		140.45	4.53	38	11.9
Kuala Pahang, Pahang ...	82.3	74.2	78.3	87	72	76	78	79.6	80.8	39.62	1006.3	6.69	20	20	1	1	...		156.70	5.05	42	11.9
Mount Faber, Singapore ...	87.2	73.3	80.3	92	71	76	75	79.7	81.1	11.56	293.6	1.68	23	20	1	9	3		159.25	5.14	43	12.1
Butterworth, Province Wellesley ...	88.6	73.4	81.0	93	70	86	76	83.6	83.4	4.88	124.0	2.47	12	10	2	13	...		233.90	7.55	...	...
Bukit China, Malacca ...	85.9	73.4	79.7	91	71	79	75	81.0	82.6	5.22	132.6	1.20	13	11	6	9	...		193.60	6.24	52	12.0
Kluang, Johore ...	86.0	72.5	79.3	91	70	77	74	80.6	81.3	8.60	218.4	3.80	16	16	...	1	12	1	157.35	5.08	42	12.0
Bukit Lalang, Mersing, Johore	82.0	73.1	77.5	85	69	77	77	79.7	80.1	14.43	366.1	2.32	19	16	...	1	...	2	168.55	5.44	45	12.0
Alor Star, Kedah ...	89.0	71.9	80.5	93	67	84	74	84.8	85.4	0.97	24.6	0.67	7	4	...	3	...		228.50	7.37	65	11.8
Kota Bharu, Kelantan ...	84.2	71.9	78.1	88	68	80	76	80.8	82.2	7.90	200.7	2.20	16	12	...	1	2		184.10	5.94	50	11.8
Kuala Trengganu, Trengganu	83.1	72.4	77.7	87	68	77	76	79.6	80.2	21.40	543.6	9.34	20	17	...	...	7		179.40	5.79	50	11.9
HILL STATIONS.																						
Cameron's Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.4	59.0	64.7	75	57	62	61	...	...	10.54	267.7	1.57	22	21	...	3	3		111.65	3.60	30	11.9
Cameron's Highlands, Tanah Rata, Pahang 4750 ft. ...	70.7	57.4	64.1	74	46	64	63	68.5	69.1	10.81	274.6	1.87	23	19	...	4	1		113.10	3.65	30	11.9
Fraser's Hill, Pahang 4268 ft.	68.9	61.2	65.0	73	59	63	63	69.8	70.0	12.90	327.7	2.40	23	21	...	4	28		100.05	3.23	27	11.9

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

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The Director of Co-operation.
The Principal, Sultan Idris Training College.
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THE

Malayan Agricultural Journal.

APRIL, 1931.

EDITORIAL.

The Quality of Malayan Copra.

During the past year, several articles concerning copra production have appeared in this Journal. Some of our readers, who happen not to be interested in this crop, may be of opinion that undue prominence has been given to this subject. In view of the fact that the area under coconuts in Malaya exceeds 600,000 acres and the value of the net exports in 1930 was over $15,300,000 the policy of this Department is to examine every aspect of the industry as we are convinced that improvements might be effected in the cultivation of the crop and the preparation of the copra which will greatly improve the quality, quantity and therefore the value of the product.

Part of the cost of our investigations on copra production is met by the Empire Marketing Board, so that we not only carry out these investigations for the benefit of Malayan producers, but as custodians of an Imperial research it is our duty to give adequate publicity to the progress of the work for the benefit also of other parts of the Empire.

With the present number of the *Malayan Agricultural Journal* we conclude a series of three consecutive articles, viz. The Economic Aspects of Coconut Research; Factors of Quality in Copra; and Types of Malayan Copra, which together with the brief review of the past six months' work by the author, Mr. F. C. Cooke, which also appears in this number, brings up to date the progress of these investigations.

The planter will ask himself how far these investigations have a practical application and whether improvements in the quality of his product will result in an enhanced price commensurate with the extra cost of production.

Before answering these points it is as well to enumerate the chief points that emerge from these investigations. They are as follows:—

(*a*) Picking of under-ripe and over-ripe nuts results in a certain loss of crop.

(*b*) Nuts of optimum ripeness yield copra of the best quality.

(*c*) Incompletely dried copra deteriorates rapidly by reason of attack by insects and moulds.

(*d*) By reason of deterioration from the above causes there is an actual loss of weight of copra.

In view of the fact that the price paid for copra by local buyers takes into account not only its present quality but the anticipated loss of weight before it reaches the crushing mill, the producer may therefore expect to receive a larger return for his copra if it is properly harvested and correctly dried.

Owing to the character of the Malayan climate, it is not possible to rely on sun-drying as a stage in the production of copra in the same way as in Ceylon or on the Malabar Coast. Malayan producers are therefore faced with the problem of producing by artificial drying alone, a copra in appearance equal to that of Ceylon or Malabar where the employment of sun-drying as a regular stage in the production of copra is practised.

The opinion is generally held that artificial means of drying copra cannot result in a product equal in colour to that of sun-dried copra. It would seem, therefore, that the first result of the application of the recommendations made by this investigator will result in an improvement in oil content and keeping qualities rather than an improvement in appearance. This is an unfortunate conclusion as the market judges quality very largely by appearance.

Satisfactory kiln drying necessitates a very considerable amount of supervision in order that an even temperature may be maintained, and it is apparent that the major part of the copra prepared in Malaya is unsatisfactory in quality by reason of faulty drying by artificial means.

Future research in copra production will therefore concern itself with an examination of the present systems of drying copra by artificial means. It is premature to state what the outcome of this work may be, but it seems likely that it will result in recommendations which may necessitate a re-adjustment of the present ideas on this subject.

Padi Soils. A review of the work in this and other countries on the subject of soil conditions suitable for padi cultivation was contributed by Mr. W. N. C. Belgrave at the Second Inter-Departmental Agricultural Conference held at Kuala Lumpur in October of last year, and is published in this number.

In view of the desirability of increasing the area under this crop in Malaya and of improving yields by the application of modern research, the subject is important.

If the figures of yields adduced may be relied upon as an indication, it would appear that, given adequate and controlled water supply, possibly existing ideas concerning the importance of soil type as a predominating factor in conditioning yields may have to be modified.

Formerly, it was thought that very heavy soils were essential for wet padi cultivation, but it would now appear that the successful exploitation of soils of a coarser texture may be possible.

Tung Oil. The use of Chinese wood oil in the manufacture of paints and varnishes has been given much prominence during recent years.

In this number, Mr. B. Bunting gives a concise account of the cultivation of the tree Aleurites spp. and the production and quality of the oil which is obtained from the seeds. Further, a statement is made of the experiments carried out by the Department of Agriculture on the cultivation of Aleurites. The important conclusion is reached that neither *Aleurites Fordii* nor *A. montana* are suited to cultivation on the plains of Malaya. It is possible that the hills of this country may prove more suitable, but unless experiments now in progress at Cameron's Highlands shew that at this elevation (5,000 feet) the tree will flourish, the cultivation of this crop on a commercial scale is not recommended.

Stem-rot of Oil Palm. In this number of the *Malayan Agricultural Journal* we take the somewhat unusual course of publishing an extract from a forthcoming Special Bulletin of the Department on "Stem-rot of the Oil Palm in Malaya" by Mr. A. Thompson, which is now in the press.

It is considered, however, that the early publication of the portion on prevention and treatment is desirable in order that those concerned with planting oil palms may be in possession of the recommendations of the Department concerning this matter.

The author concludes that diseased trees may be cured if treated at an early stage. This method is costly, but inevitable when the disease is established.

The alternative would appear to be clearing the land of all jungle stumps and fallen timber as it is considered that the disease originates from fungi which grow on such timber. This recommendation is the outcome of the observation that there are at present no signs of stem-rot on the palms at the Government Experimental Plantation, where the land has been cleared of all timber and stumps.

It is, perhaps, premature to advocate the policy of clean-clearing as a preventative of stem-rot, but there is much to justify the policy; so that those concerned in this question would be well advised to examine the incidence of stem-rot on their plantation in relation to the amount of fungi found on the decaying jungle stumps and timber on the land.

TUNG OIL OR CHINESE WOOD OIL.

B. Bunting,

Agriculturist.

Tung oil, which is more commonly known as the Chinese Wood Oil of commerce, has of recent years become of increasing importance in the manufacture of paints and varnishes, particularly where a hard surface or a high gloss is required. The oil came into prominence during the War, when it was extensively used in the treatment of aeroplane fabrics. It is also employed in the manufacture of linoleum.

At the present time, the principal source of production of Tung oil is in China, where the value of the exports of this oil amount to over three million pounds sterling annually.

The following figures show the exports of Tung oil from China during the period 1926 to 1928 :—

		Tons.	*Value.*
1926	... ...	44,535	£2,330,215
1927	... ...	53,648	3,095,371
1928	... ...	65,137	3,404,268

It may be of interest to record that America is the principal consumer of Tung oil and in 1929 the imports into the United States were 53,428 long tons, valued at £3,082,578. The imports into the United Kingdom for the same period amounted to 4,154 tons, valued at £273,350.

In view of the fact that the United Kingdom, as well as other countries, is entirely dependent upon China as the source of supply of Tung oil, a memorandum (1) on the production of Tung oil in the Empire has been prepared by the Imperial Institute and published under the auspices of the Empire Marketing Board with the object of investigating the possibilities of producing this oil by the cultivation of Tung trees within the Empire.

Sources of Tung Oil.

According to the above mentioned memorandum, there are two species of *Aleurites* which produce the Tung oil of commerce and the following information is given regarding the botanical nature of the plants and their distribution :—

"Tung oil is obtained from the seeds of *Aleurites Fordii* Hemsl., a tree which grows abundantly in central and western China. Another species, *Aleurites montana* Wils., found in south-eastern China, yields "Mu-yu" oil, which is stated to possess similar properties to those of Tung oil. These two oils, sometimes indiscriminately mixed, are exported from China under the name of Chinese Wood oil."

(1) "The Production of Tung Oil in the Empire," published by His Majesty's Stationery Office, London, June, 1930, price 1s. 0d. net.

"Our knowledge of the distribution of these two species is limited but there seems to be no doubt that *A. Fordii* furnishes the bulk of the Tung oil exported from China. *A. Fordii* is a quick growing, small tree which occurs in the warm temperate parts of China, especially in the Yangtze valley, where the Chinese grow small plantations on hill-sides on land unsuitable for ordinary cultivation. Here the summers are warm enough for such crops as rice and giant millet, while wheat is grown in the cold weather when slight frost and snow may occur on high ground. *A. montana* extends from the Province of Chekiang in south-eastern China to Tonkin in French Indo-China and the Shan States of Burma. The presumption therefore is that *A. Fordii* is likely to thrive best in climates which are less tropical than those which favour *A. montana* and that the latter species may require a heavier hot-weather rainfall than the former. Trials with the two species on the American continent seem to support this. In size, habit, foliage and general appearance the two species are similar; both are deciduous and shed their leaves at the commencement of the cold weather. In both, the fruits are roughly spherical and about 5 cm. in diameter, but they may be readily distinguished because the outer surface of the fruit of *A. Fordii* is smooth while that of *A. montana* has wavy transverse ridges. The fruit of *A. Fordii* has from three to five one-seeded segments while that of *A. montana* usually has only three."

"There are three other species of *Aleurites* which also bear oil-yielding seeds, namely, *A. cordata* Steud., the source of Japanese wood oil; *A. triloba* Forst. (= *A. moluccana* Willd.), yielding candlenut or lumbang oil, and *A. trisperma* Blanco. Their oils have not the same special properties as those of *A. Fordii* or *A. montana* and cannot replace them in the paint and varnish trade."

Climatic and Soil Conditions.

The following is a brief description of the conditions under which *A. Fordii* is found growing in its native habitat in China :--

"*Rainfall and Temperature.* As the tree is deciduous and flowers before producing its leaves, it appears probable that it will succeed best under climatic conditions affording it a resting period. For successful cultivation the absence of much frost and a sufficient rainfall are essential. The rainfall should not be less than 30 inches, 50 or even 70 inches being preferable. In Ichang, China, where this tree flourishes, the average rainfall is 30 inches, most of which falls in April, July and August. Here the climate is rather one of extremes. The summer is tropical with a shade temperature ranging from 90° to 110°F. The winter is cold, snow often lying on the ground for days, but there are seldom more than 4 degrees of frost. In the mountains, at 2,600 feet altitude, the summer is somewhat cooler and the temperature may fall to 24°F. and occasionally as low as 20°F. Experience within the Empire indicates that this tree is very resistant to drought and can withstand very high summer temperatures."

"*Soil.* In China the tree appears to have no strong predilection in the matter of soil, and grows equally well on conglomerate, hard limestone, sandstone or

sandy clay. It is essentially a hillside tree, thriving in the most rocky situations and in the poorest of soils. In America the tree has been tried on almost every type of soil, and has been found to grow on practically any well-drained soil which is slightly acid. The type of soil which is found most suitable in Florida is a sandy or sandy loam soil which is underlaid with clay 3 to 8 feet down."

The climatic conditions described above would appear to preclude the possibility of establishing *A. Fordii* successfully even on the hills in this country, more particularly if the plant requires a definite resting period.

In view of the interest which is now being taken in the possibilities of the production of Tung oil on a commercial basis a resumé of the information contained in the memorandum referred to above is given below :—

Cultivation of Tung Trees.

The common method of reproduction of *A. Fordii* is by seed, but the plant can be established by budding and grafting and also propagated from cuttings.

In China the trees are planted on waste hillside land and no attempt appears to have been made to grow them as a regular plantation crop in that country.

As a result of trials carried out by the United States Department of Agriculture it was found that *A. Fordii* fruited well in certain of the Southern States. In fact these trials were considered so satisfactory that in 1923 a company was formed by the American Paint and Varnish Manufacturers' Association with the object of proving that Tung oil trees could be grown successfully in America as a plantation crop. The first plantations were established at Gainsville, Florida and comprised an area of about 270 acres. In 1929, the area planted in Florida had increased to 5,000 acres, while an additional 500 acres have been planted in States other than Florida.

Planting Distance. From experience gained in Florida it is recommended that the trees be planted 30 ft. x 12½ ft. After the seventh year alternate trees are removed so that the distance in the rows is increased to 25 feet, which gives approximately 60 trees per acre.

It is stated that in China the trees rarely exceed a height of 30 feet and have a spread varying from 15 to 30 feet. In Florida eight-year-old trees frequently attain a height of 30 feet with a spread of about 28 feet.

Harvesting. The fruiting season in both China and Florida is generally about October.

In China the fruits are removed from the trees by means of poles before they are properly ripe. They are then placed in heaps, which are covered with straw or grass, and allowed to ferment. In the process of fermentation the outer husk is loosened, thus facilitating the removal of the seed.

The practice in Florida is to allow the fruits to ripen on the trees. When ripe they fall to the ground and are allowed to remain under the trees until quite dry.

Yield. In Florida the trees generally come into bearing about the fifth year and reach full bearing in their tenth year. Although it is too early at

present to form any reliable estimate as to the production of tung oil from trees grown under plantation conditions it is on record that six-year-old trees on a plantation in Florida produced a yield of approximately 1,300 lbs. of dry fruit per acre, which is equivalent to about 280 lbs. of oil per acre per annum.

Marketing the Produce. The nuts after being separated from the outer husks should be thoroughly air-dried and bagged for shipment. The nuts are composed of about 43 per cent. of shell and 57 per cent. of kernel. The kernels contain about 56 per cent. oil, which is readily expressed by the usual method of crushing in hydraulic presses.

It is considered that oil prepared in England would be of lighter colour and much superior in quality to the Chinese-made product, while its purity could be guaranteed. Further, it is stated that such oil would possibly command a premium over the Chinese product, which was quoted at £69-10s. per ton in London in January, 1930.

Departmental Experiments with Aleurites.

The Department of Agriculture, S.S. and F.M.S. has carried out numerous experiments with various species of Aleurites and the following information has been obtained regarding the growth of both *A. Fordii* and *A. montana* under Malayan conditions :—

(a) Aleurites Fordii.

Seeds of *Aleurites Fordii* were received from the Bureau of Plant Industry, Department of Agriculture, United States of America in January, 1914. These seeds germinated freely and the resultant seedlings were planted at the Government Experimental Plantation, Kuala Lumpur on an area of land adjoining the offices of the Department of Agriculture. Although the plants showed considerable promise at the start, after attaining a height of about 5 or 6 feet their growth was completely arrested and they soon developed a stunted appearance which clearly indicated that this particular species of *Aleurites* was totally unsuited to cultivation under local climatic conditions. In March, 1924, which was over 10 years from the date of planting, the Agriculturist then in charge reported as follows :— "Only four plants of this species now remain and they are in very poor condition, although they have been well cultivated and manured. The trees average 5 feet in height, have very few branches and are practically devoid of leaves." The plants in question never showed any signs of flowering and eventually their cultivation was abandoned.

It is intended to carry out further trials with this plant at the Experimental Plantation, Cameron's Highlands, which is situated at an elevation of about 5,000 feet above sea level, but the possibility of success at this elevation is somewhat doubtful, since the tree apparently requires a much cooler climate and a definite resting period for its proper development.

(b) Aleurites Montana.

Experiments at Kuala Lumpur. A small consignment of seeds of *Aleurites* ***montana*** was received from the Superintendent, Botanical and Forestry Depart-

ment, Hong Kong, in December, 1919. The seeds showed a very good percentage of germination and the seedlings were planted on terraced land at the Experimental Plantation, Kuala Lumpur at distances of 20 feet apart in March, 1920. The plants made vigorous growth at first, but after a time they became somewhat straggly and began to throw out numerous suckers near the ground. Measurements of the trees taken in March, 1923 showed that they ranged from 4 feet to 16 feet in height, while the girth varied from 6 inches to 14 inches at two feet from the ground. The wide variation in both height and girth indicates the general unevenness in the growth of the trees under this trial. Further measurments taken in January, 1924 showed that the girth of the trees varied from 7 inches to 22½ inches, but the average height was only 11 feet.

A few trees commenced to flower in January, 1924, which was about 4 years after planting but the majority of the flowers did not set, with the result that only one or two isolated fruits were produced. Since the trees showed no further signs of fruiting and a large number subsequently died, their cultivation was abandoned early in 1926, the experiment having proved a complete failure.

Experiments at Serdang. A further consignment of 735 seeds of *A. montana* was received at the Experimental Plantation, Serdang (2) from the Botanical and Forestry Department, Hong Kong in November, 1924. The seed, which was sown in boxes containing prepared soil, commenced to germinate about a month later and germination continued for a period of nearly two months, giving about 45 per cent. germination. As the seedlings developed they were removed from the seed boxes and transplanted into small bamboo baskets, which were kept under shade in nursery beds for a period of about two months.

A plot of land, comprising approximately 3½ acres, situated at the base of a steep hill was selected as being the most suitable area for this crop. The soil, which was fairly even throughout the area, may be described as a heavy laterite loam.

The basket seedlings were planted out in this area during March, 1925 at a distance of 20 ft. x 20 ft. square, which gives 108 trees per acre.

After planting, growth was fairly rapid, especially in the case of the trees planted on the lower part of the area. One tree commenced to flower in March, 1926 and a few mature fruits were collected in April, 1927, *i.e.*, two years after planting in the field. A number of trees flowered during 1927 and a small quantity of seed was collected during that year. Early in 1928 more trees flowered and in the following June 35 lbs. of seeds were harvested from five of the largest trees. At the end of 1928 the majority of the trees had reached the flowering stage, but only a small number were bearing fruit. The following is a record of the weight of cleaned nuts produced during the past three years from the area in question :—

(2) *Malayan Agricultural Journal,* Vol. XVII, 1929, page 47.

Year.	*Weight of cleaned seed.*
	lbs.
1928	34 lbs.
1929	30 „
1930	68 „

Flowering and fruiting occurs throughout the year but is more pronounced during the dry seasons, *i.e.* January—February and July—August.

The fruits are allowed to ripen on the trees and fall to the ground. They are then left under the trees until thoroughly dry when the husk of the fruit splits open from the base upwards and the seeds are easily extracted.

The records at Serdang show that 160 sun-dried seeds weigh one pound; which is approximately the same figure as the seed originally obtained from Hong Kong.

The following measurements, which were taken at the end of 1930, show to what extent the trees are likely to develop under the conditions obtaining on the plains in Malaya:—

Average height	=	18 feet.
Average spread	=	19 „
Average circumference at two feet from ground ...	=	20 inches.

The general behaviour of the individual trees is most erratic and specimens are to be found flowering, fruiting and wintering at the same time, which may possibly be due to the absence of a definite resting period. It has also been observed that so far the number of female flowers produced is proportionately small and this naturally affects the crop.

The yields of fruit to date have been extraordinarily poor considering the age of the trees and it would appear that this particular species of *Aleurites* is also unsuited to the conditions prevailing on the plains in Malaya.

The following information has been published by the Department (3) regarding (a) the oil content and (b) the analytical constants of oil from seeds of *A. montana* produced at the Experimental Plantation, Serdang:—

Oil Contents of Seed.

Average weight of seed	2.8 grammes.
	per cent.
Proportion of shell	47.2
Proportion of kernel	52.8
Kernel.	
Moisture (loss at 100°C.)	5.4
Oil (petroleum ether extract)	43.2
Residue (by difference)	51.4
Oil (calculated on moisture-free basis) ...	45.7
Seed.	
Oil (calculated on whole seed)	22.8

(3) *Malayan Agricultural Journal,* Vol. XVI, 1928, page 297.

Analytical Constants of Oil.

Constant.	*Oil from A. montana.*	*Chinese Wood oil.*
Oil.		
Specific gravity at 15.5°C.	0.939	0.935 —0.940
Refractive index at 20°C.	1.5098	1.5179
Saponification value	195.5	193.0
Iodine value (Wijs)	160.3	170.6
Acidity (Oleic Acid per cent.) ...	1.8	
Unsaponifiable (per cent.)	0.6	
Fatty Acids.		
Solidifying point (Titer value) ...	36.8°C.	37.2°C.
Mean molecular weight	298.4	297.1
Neutralisation value	188.0	188.8
Iodine value (Wijs)	164.7	144 — 159

The figures for Chinese Wood oil are taken from " *Chemical Technology and Analysis of Oil, Fats and Waxes*", Lewkowitsch and Warburton, Vols. I and II, for purposes of comparision.

It will be observed from the above figures that the physical and chemical constants of the oil from *A. montana* agree closely with those of Chinese Wood oil except for a small difference in the iodine value.

Conclusions.

As a result of the various trials carried out by the Department with *A. Fordii* and *A. montana* at the Experimental Plantations, Kuala Lumpur and Serdang, it would appear that both these species of Aleurites are unsuitable for cultivation on the plains in this country. Further trials, however, are being carried out at the Experimental Plantation, Cameron's Highlands at an elevation of about 5,000 feet and until such trials have proved successful the cultivation of either *A. Fordii* or *A. montana* on a commercial scale in Malaya cannot be recommended.

Departmental Publications on Aleurites.

The following is a list of articles published by the Department of Agriculture, S.S. & F.M.S., on the various species of Aleurites :—

1. " Tung Oil or Chinese Wood Oil and Candlenut Oil from Aleurites Spp." by B.J. Eaton,—*Agricultural Bulletin, F.M.S.*, Vol. VII, 1919, page 162.
2. " Oil from Aleurites Species" by C.D.V. Georgi.—*Malayan Agricultural Journal*, Vol. X, 1922, page 202.
3. " Candlenut and Chinese Wood Oil Trees", by W.N. Sands.—*Malayan Agricultural Journal*, Vol. XII, 1924, page 1.

4. "Oil from Aleurites Trisperma", by C.D.V. Georgi,—*Malayan Agricultural Journal,* Vol. XIV, 1926, page 290.
5. "Oil from Aleurites Species," by C.D.V. Georgi,—*Malayan Agricultural Journal,* Vol. XIV, 1926, page 290.
6. "Preliminary Report on the Cultivation of Candlenut at Serdang", by T. D. Marsh,—*Malayan Agricultural Journal,* Vol. XVI, 1928, page 212.
7. "Oil from Aleurites Montana", by C. D. V. Georgi, and Gunn Lay Teik,—*Malayan Agricultural Journal,* Vol. XVI, 1928 page 296.
8. "Preliminary Report on the Cultivation of Aleurites Montana", by J. N. Milsum and T. D. Marsh,—*Malayan Agricultural Journal,* Vol. XVII, 1929, page 47.

Acknowledgement.

The writer wishes to make due acknowledgement for the information extracted from the memorandum prepared by the Imperial Institute entitled "The Production of Tung Oil in the Empire", published by the Empire Marketing Board, and to the various Departmental publications mentioned above.

TYPES OF MALAYAN COPRA*

BY

F. C. Cooke,

Assistant Chemist for Copra Research.

The quality of copra varies considerably for different districts. On the rough " F.M." and " F.M.S." sorting basis the following comparative and approximate figures for the "mixed" copra were derived from a few selected districts :—

TABLE 1.

Quality of Copra from different districts.

Lowest grade :—	Imported (A)	100 per cent.	F.M.
	East Coast (A) West Coast (A) Imported (B) East Coast (B)	60—80 per cent.	F.M.
	Imported (C)	50 per cent.	F.M.
	West Coast (B) West Coast (C) West Coast (D)	20 per cent.	F.M.
Highest grade :—	West Coast (E)	10—15 per cent.	F.M.

(The letters refer to the place of production.)

The quality of copra from all districts suffers to some exent from the picking of young nuts while in two West Coast districts this fault is particularly marked.

Unless physical properties are taken into consideration, the analyses of samples taken from bulked copra (See Table 2) can be very misleading since the moisture is generally erroneous because the small sample received has usually dried in transit; the oil percentage (or either extract, dry basis) of bad copra may be as high as 74 per cent. or as low as 60 per cent. according to the ripeness of the nuts, the degree and manner of deterioration by moulds and insects, losses by burning and the extent of free acid reduction by ventilation; while the acidity varies with the moisture percentage and the time and conditions of storage of the copra.

More significant analytical results are, however, obtained after copra has been

* The following is the concluding part of a paper read at the Second Inter-Departmental Agricultural Conference, Kuala Lumpur, F.M.S., on October 30th, 1930. The first two parts were published as follows :—The Economic Aspects of Copra Research. *Mal. Agr. Journ.* February 1931, and Factors of Quality in Copra, *Mal. Agr. Journ.*, March 1931.

sorted on the basis of appearance. A complete comparison of almost every selected quality available on the market is given in Table 3. The results were obtained by an analysis of 5 lb. samples, the free acidity being determined on the expressed oil; while the thickness of the copra was obtained by taking the average of a number of pieces of each type. In the case of insect-ridden copra, this rough comparison was obtained by weighing similar slices.

The results shew definitely that careful nut collection and copra preparation are rewarded by the highest oil and copra yields. It must again be pointed out that incorrect picking, faulty preparation and all subsequent deterioration is paid for by the Malayan producers. Even though they contribute their share of work in helping the material on its way to the manufacturer, the middlemen are merely percentage takers and the price they are able to pay is a more or less accurate reflection of the ultimate quality of the product.

If the dealers were to receive a well-dried and well-prepared product from all sources within Malaya they would not need to resort to redrying. Furthermore, the deterioration in shipment would be so greatly reduced that they could safely offer a better price.

TABLE 2.

Chemical Analysis of Bulk Samples of Native Copra.

District.	Oil Percentage (dry basis)	Acidity Percentage.
West Coast (C)	* 67.2	.5
	64.3	.9
	64.8	.7
Imported (B)	* 67.6	1.5
	* 68.6	1.4
	* 68.2	2.5
Imported (D)	* 68.4	.9
	64.1	.2
	* 66.0	3.0
Imported (A)	64.7	2.3
	* 66.6	1.6
	* 67.8	3.4
West Coast (A)	* 68.2	1.7
	* 68.7	1.1
	65.8	1.7
East Coast (A)	* 68.0	1.9
	64.3	2.2
	* 67.8	3.1
Average—Native Copra ...	* 67.0	1.7
Compare		
Average—Estate Copra ...	65.6	.1

* Note high oil percentage and high acidity.

Nut Harvesting.

The chief problem that has been studied during the past year is the development of meat and oil within the nut during ripening and the advantages of storing nuts for one month previous to drying as is the usual practice in Ceylon. It is hoped to produce a special report on this subject shortly when the work is completed.

The general indications are: firstly, that fully ripe brown nuts containing an haustorium about 1 inch in diameter will give the highest total oil and copra yields; secondly, that the meat of green unripe nuts contains about 60 per cent. moisture, while ripe nuts yield wet meat containing between 40 and 50 per cent.; and thirdly, that there is no advantage in storing nuts, either ripe or unripe, for one month before extracting and drying the copra, except that the contained meat becomes firmer and drier.

Drying and Storage.

Apart from considerations of oil and copra yield, the indiscriminate collection of very under-ripe and over-ripe nuts together with ripe brown nuts and the subsequent drying together of meat containing different degrees of moisture must result in an irregularly dried product. Some pieces will be over-dried, burnt and yellow, while the pieces of under-ripe meat will still be wet and in storage will become slimy and mouldy and will make the remainder wet.

Little investigation has yet been carried out in Malaya regarding copra drying beyond an examination of the performance of different types of driers in use in the country. It seems that the drying of copra has been speeded up at the expense of quality of the product and as a result examples of "case-hardening", "caramelisation" and "black-burning" are quite common. Whereas the period for kiln-drying in Ceylon is between 5 and 7 days, in Malaya 4 days is the maximum, while as little as 24 hours drying has been recorded in several instances. For native production, 48 hours is approximately the standard period, while estate production usually involves 72 hours drying. It must not be thought that accelerated drying must be ruled out entirely, but the correct conditions essential for the production of satisfactory copra have yet to be ascertained. Great heat applied to the product at the wrong time, local overheating, absence of air movement in certain parts of the mass being dried, combined in some cases with the deposition of soot and tarry volatiles owing to bad firing, all contribute to produce an unsatisfactory product.

Possible Oil Loss.

While it has been proved in the Philippines *and confirmed in Malaya that ordinary coconut oil does not lose weight if it is heated at 100°C for three days, results to date lead to a strong suspicion that the oil yield (by the ether extract

* *Phil. Journal of Science* March 1917. "Copra and Coconut Oil" Brill, Parker and Yates.

TABLE 3.
Types of Malayan Copra.

Type of Copra.	Acidity Percentage.	Oil Percentage (dry basis)	Oil Percentage (as received)	Estimated thickness of copra Mms.	Estimated Yield Oil	Efficiency per nut. Copra
Perfect Sundried ...	.1	65.4	62.1	9.0	100	100
Typical F. M. S. Copra ...	.33	65.6	61.9	9.0		
Wrinkled } Copra from unripe nuts ...	.63	60.0	55.2	5.0	51	56
Leathery } Copra from unripe nuts ...	1.6	59.1	55.0	5.3	54	59
Thin Copra from overripe nuts ...	5.01	74.2	70.7	4.5	60	52
Burnt Black ...	.70	69.0	65.7	8.0	97	90
Burnt ...	.34	64.9	60.3	8.5	94	96
Caramelised and slight insect attack ...	.24	64.8	61.5	8.5	66	96
Burnt and heavy insect attack ...	1.50	60.1	56.9	7.0*	74	80
Very severe insect attack ...	1.60	64.8	61.5	6.0*	68	66
Slimey, black and rancid ...	5.01	73.7	68.8	7.5	80	72
Heavily, black moulded ...	5.25	68.3	64.3	8.5	92	88

* Estimated by comparative weights of similar slices.

method) of the copra prepared from the same wet meat under different conditions can show serious differences. The explanation of this anomaly, if conclusively proved, is not obvious and investigation of the problem is still proceeding.

Case-Hardening:—A number of samples of copra produced by accelerated drying have been examined and the structure of these samples has been found to be a hard smooth skin covering a wet core. This structure makes subsequent re-drying by storage, which is a regular commercial practice, an unprofitable proceeding because, while the moisture from the main bulk of the copra is lost only very slowly, insect attack and mould growth with acid formation are able to proceed freely whenever the crust is broken.

For sampling, the copra was sliced tangentially into four slices parallel to the testa or brown skin.

TABLE 4.

Moisture Gradient in Copra.

Sample	Moisture percentage.			
	Slice A (Inside face)	Slice B (Interior)	Slice C	D (Testa)
1. Immediately after rapid drying ...	8.2	16.7	—	—
2. Native copra, glossy caramelised skin, after long storage	4.7	8.1		
3. Sundried for 3 days. ...	11.6	7.1	5.3	7.6
4. Typical wet undried coconut meat (for comparison) ...	80.0	50.0	35.0	15.0

The first two examples in Table 4 are of "case-hardened" copra, whilst sample 3 illustrates uniform drying. It will be seen that each slice of sample 3 has been dried seven fold, whereas in the case of sample 1 slice A has dried ten fold and the wet core, slice B has only dried three fold.

The bad effect of the redrying by storage has already been referred to while the uselessness of such a proceeding for case-hardened copra was shown by an analysis of such copra, before and after two week's storage in bulk.

TABLE 5.

Effect of Storing Copra with a Wet Core.

Case-hardened copra.	Average moisture percentage.	Average acidity percentage.
Sample (1) as above, before storage ...	8.2	.04
Sample (2) the same after 14 days storage for further drying	7.7	1.36

The difficulties of the manufacturer in dealing with a "case-hardened" copra have previously been mentioned.

Under-drying. Insufficient kiln-drying caused by deliberately curtailing the drying period, or by the copra having been too thickly piled on the drying platform, raises a very serious situation for all the native producers concerned. In one district, the price of wet copra of excellent appearance is only $4 per picul. A deadlock has been reached, because the producer receives no incentive to improve his product; the general tendency is therefore to include as much water as possible. Organised selling could probably right this situation and bring about a better understanding between buyer and seller and so ensure a better product and a better cash return.

Conclusion.

Considerable stress has been laid on the bad points of Straits Copra and on native-produced copra in particular. While no guarantee can be given that the adoption of some of the above recommendations will result in an added financial return, it must be emphasised that as increasing supplies of edible oil of all kinds become available and as the increased plantings of coconuts during and just after the war is resulting in ever-increasing world yields of coconut oil, a position may ultimately be reached when the market will become so seriously discriminating and competitive that bad copra will be unsaleable at a profit. Should the general quality of Malayan copra meanwhile be advanced to make it an outstandingly good product and nut collection be organised to obtain the maximum yields, the position of this country will then be considerably strengthened.

It has been shown that the system of marketing is as much the concern of the producer as of the trader, for the losses resulting from bad methods are his losses. Until it is recognised that lack of organisation, particularly among native growers, leaves them entirely in the hands of the middlemen and effectively prevents the all-round production of really dry, good quality copra which will maintain both quality and quantity in storage, the standard of Malayan copra will continue to be low and the best return will not be obtained. The individual grower, working alone on a small scale cannot successfully market his product to the best advantage to himself except in very special cases and market conditions do not encourage him to take extra trouble and to produce only copra of first-class quality.

The following recommendations are submitted :—

(1) As far as possible, nuts should, as in Ceylon, be allowed to fall naturally.

(2) If the nuts are picked, only fully ripe brown nuts should be harvested. Nuts slightly germinating, with about a 1 inch haustorium give the highest oil and copra yield.

(3) Where fallen nuts only are collected and the labour of picking is saved, collecting tours can be more frequent.

(4) Drying should not be hastened unduly, or unduly curtailed; burning should be avoided and uniform drying assured by free air movement through the copra and by uniform nut collection.

(5) Drying should proceed until the copra contains 6 per cent. of moisture.

(6) Clean, freshly prepared copra should be placed in clean, close woven bags immediately after drying which should be closed to prevent the ingress of insects.

(7) The bags of copra should be stored in clean, dry, rain-proof stores which allow free air movement around each bag.

(8) The possibilities of baling either by a power operated machine at a central receiving depot, or otherwise by a manual machine should be explored further, chiefly because baled copra is considerably less bulky than copra in sacks and so freight is saved.

(9) Producers, particularly native producers, should consider co-operative marketing, so that a better grade of copra may be marketed. An improved price for native copra of good quality and the avoidance of copra loss will result in improved financial returns to these producers.

Errata. Paragraph 1 line 3 of the previous article " Factors of Quality in Copra " in the March issue of the *Malayan Agricultural Journal* should be amended to read as follows :—

.... " If these conditions are satisfied, the copra will generally arrive in Europe insect and mould free, white and sweet unless the consignment is exposed to insect infestation 'en route' or is rewetted."

SOME OBSERVATIONS ON CHARACTERISTICS AND TREATMENT OF PADI SOILS *

BY

W. N. C. BELGRAVE,

Plant Physiologist.

In this paper it is proposed to give a summary of recent work on a few selected problems; many others such as soil atmosphere, soil flora and nutrient requirements will be omitted.

The Soils of Rice Growing Countries and their Relation to Yield.

It has proved difficult to get a clear picture of the rice soils of other countries, even of soils on which experimental work has been carried out. Many writers content themselves with the statement that experiments were conducted at " X " station, others describe soils by a class name which may have only local significance and quite frequently writers differ widely as to the characteristics of what they describe as typical rice soils of a given country.

There is still more uncertainty as to the degree of care which has been exercised, when assigning yields, to secure reliable figures which have not been vitiated by extraneous factors such as pests or water supply.

Taking the figures for what they may be worth we find for physical characters the following :—

Philippines (*Riz and Riziculture Vol. I*) the most usual soil is said to be sand 20 per cent., clay 45 per cent., humus 35 per cent. This would, of course, give an extremely open textured soil *if* the remarkably high humus figure is correct.

Java. From internal evidence in Wulff's compilation (to be discussed later) Java soils appear to show a minority of stiff clays or silts.

Burma. Warth (*Chem : Memoirs Dept. Agric. India V. p. 131*) who carried out pot experiments with a large number of Burma soils, unfortunately gives no physical analyses but relies on " soluble silica " as an index of texture. This is unfortunate as degree of laterisation will affect the relationship—from his figures there would appear to be a very extensive range from very stiff to very sandy soils.

The most ambitious attempt at comparison of soils emanates from Ceylon—"Contributions to the study of the paddy soils of Ceylon and E. Countries" Bruce, *Department of Agriculture Ceylon Bulletin 57 '22.*

Samples were collected from S. India, Ceylon, Burma, Malaya, Philippines, Siam and Japan by workers in those countries and were analysed in Ceylon. In

* **Paper read at the Second Inter-Departmental Agricultural Conference, Kuala Lumpur, F.M.S., on October 28th. 1930.**

order to allow for changes in methods of expressing analyses, the results given by Bruce for Malaya are included in the following summary of his work:—

Physical characters. (Bruce)

Malaya. Malayan soils contain from 27 per cent. fine sand, (Titi Serong) to 46 per cent. fine sand at Klebang Ketchil (Malacca). Fine fractions are approximately 40 per cent. clay +fine silt and 20 per cent. coarse silt (all analyses are, of course, on the old method). "Humus" is low, being 2.9 per cent. for Titi Serong. Yields vary from 1,500 lbs. per acre in the Ulu Muar district (=290 gantangs approx.) to 2,500 lbs. per acre in Malacca and 2,400 lbs. per acre (=460 gantangs per acre) in Titi Serong.

Ceylon. Soils from the S. E. Province of Ceylon (Galle and Matara districts) contain 5—12 per cent. of humus, high clay, low fine sand (only 9 per cent.)* but about 12—20 per cent. coarse sand and gravel. Those from the remainder of the Island have low fine fractions silt + clay 8—35 per cent. and high coarse sand and gravel (30—70 per cent.) with low humus. All planting is broadcast; there is a small amount of manuring in some districts and irrigation is widespread. Yields in the S. E. Province are, on two of the soils examined, 500—700 lbs. per acre and in one 3,000-4,500 lbs. per acre; while on the others (sandy soils) they are 675-1,000; 900 and 1,440 lbs. per acre respectively.

S. India. Three soils were examined, all show low humus, 27—40 per cent. clay and fine silt, 22—36 per cent. fine sand and 20—30 per cent. coarse sand +fine gravel—transplanting is practised and in some cases cattle manure is applied—irrigation is practised. Yields are 1,800-2,600 lbs per acre.

Burma. Five soils were examined humus is low (1.8-3.1 per cent.), clay and fine silt high (50—70 per cent.), fine sand low (9—15 per cent.) and coarser sand is absent. Yields are all approximately 2,000 lbs. per acre. There is no irrigation.

Philippines. Two soils. Humus low (1-2.5 per cent.) (contrast figure on.p. 173) clay and fine silt 20—33 per cent.; fine sand 20 per cent. and coarse sand and fine gravel 40-50 per cent. Transplanting and irrigation are practised, manuring is not, and yields are 1,500-1,900 lbs. per acre. The low figure for humus is difficult to reconcile with the very high one given above.

Siam. Three soils. Humus is not given but from loss on ignition it may be expected to be moderate, clay and fine silt 60—65 per cent.; fine sand 3—12 per cent.; no coarse fractions. Neither transplanting, manuring nor irrigation; yields are 960-2,400 lbs. per acre.

Japan. Four soils. Humus moderate 2.5-5.6 per cent., clay and fine silt 17-38 per cent., fine sand 20-42 per cent. and coarse sand 16-24 per cent.; in one case gravel 19 per cent. Transplanting, manure and irrigation are employed and yields are 1,700-3,500 lbs. per acre.

Chemical Characters.

(Bruce) These are somewhat confusing—as usual the figures for pH lose most of their value as the method of determination is

* 1 gantang is taken as weighing approximately 5.2 lbs.

not given—for what they are worth our soils are stated to be 'sour' pH 4.7—5.5: Japan cames next 6.5—7.2—Ceylon 5.7—8.3, Philippines 7.5; Siam is not given and S. India and Burma 8.2—8.7.

Nitrogen is in general 0.10 per cent. to 0.25 per cent. with very low figures for S. India of .05—.08 per cent.

Lime in Ceylon, Malaya, Siam and part of Japan is 0.1—0.5 per cent. while in S. India, Burma, Philippines it is 0.6—2.0 per cent.

Magnesia varies in a similar manner.

Potash is very low 0.1 per cent. in Siam and in some of the Ceylon soils, moderate 0.3—0.7 per cent. in Malaya, the remaining Ceylon soils, Philippines and Japan, and high in S. India and Burma.

Phosphoric Acid (P_2O_5) Total phosphorus is lowest in Siam 0.04—0.07 per cent. and from 0.08—0.25 per cent. in the remainder, no regular variation being found.

Available phosphoric acid is lowest in Malaya and Siam (0.004 per cent.) averaging 0.015 per cent. in the others; no great regularity is shown.

Analyses from other sources.

Siam. Detailed analyses of Siam soils are given by Ladell (*Technical Station Supplement to Record No. 6, 1930*) and agree with Bruce's figures. Ladell records instances of rapid fall in yield, in one case amounting to 50 per cent. of the original in 5 years. He attributes this to accumulation of soluble salts and acidity owing to poor drainage. His pH in suspension varies from 3.75 to 4.53 and shows no correlation with yield; he finds his water extracts all to be 6.5 pH.

Burma. Warth, mentioned above, deals in considerable detail with Burma soils, unfortunately without stating yields. Many of his total P_2O_5 figures are as low as 0.01 per cent.—but he extracted with unheated acid which renders comparison doubtful.

Hendry (v. inf.) who also deals with Burma soils and gives the country average yield as 1,500 lbs. per acre points out that, contrary to general belief, the better padi lands of Burma receive no annual silt deposit, being above flood level. He can trace no decline in fertility since 1872, the first year of reliable records. He considers this to be due to the fact that break-down to soluble nutrients now equals uptake by the crop.

Malayan soils. Most of our own analytical work has been on physical analysis—and I am deeply indebted to the Field Officers who collected the large number of samples required. With each soil was sent an estimate of yield; this naturally is only an approximation, but is unlikely to err by being too high. Taking the figures for what they are worth and excluding all samples in which an explanation other than that of soil was given for low yields or in which the analyses showed considerable differences between top and subsoil, we have the results set out in Table A. Naturally, these distribution tables must not be taken as representative of the relative *extent* of each class in Malaya, since no account is taken of the extent of any particular area. We find no correlation between mechanical composition and yield and further find, assuming yield of figures and sampling

to be even approximately correct, that soils light in texture compared with those of the chief rice-growing districts are capable of providing quite useful yields.

This confirms the deductions to be drawn from the analyses given above for other countries, and suggests that given accessibility and an adequate water supply, caution should be exercised in condemning a soil on the ground that it is not heavy.

TABLE A.

Sand Percentage.

0—20	21—40	41—60	61—80	Total.	Gantangs per acre.
3	1	1	1	6	0—80
5	9	7	4	25	81—180
20	26	24	15	85	181—280
17	19	24	9	69	281—380
15	20	15	3	53	381—480
6	4	4	1	15	481 upwards
Total 66	79	75	33	253	

Figures represent numbers of soils in each class.

Chemical analysis reveals nothing of special interest, and yield could not be correlated in any way with figures for nitrogen, ammonia, or phosphorus (total or available).

The soils are all acid in suspension varying from 4.2 to 5.8 pH. Acidity in clear extracts in very much less and does not confirm Ladell's theory of acid accumulation. Nitrogen varies from 0.1 per cent. to 0.6 per cent. and P_2O_5 from 0.04 per cent. to 0.17 per cent.

Manuring.

Manures may be divided into artificials, animal and green; or mixtures of these. Taking artificials first we have:—

Nitrogen. There is general agreement that nitrates are without effect or

are even deleterious to wet padi, although in the Philippines they have been found to be beneficial to dry padi. The explanation is usually sought in denitrification under anaerobic conditions, formation of nitrites, and rapid leaching. The popular view that rice can absorb nitrogen only as ammonium salts appears to be unfounded (v. inf.)

Nitrogen in artificial fertilisers is usually applied in the form of ammonium sulphate (or latterly one of the ammonium phosphates) and in general in conjunction with phosphatic fertilisers. In only a few instances have nitrogenous fertilisers alone in controlled experiments given considerable increases.

Potash. Potash has not, in general, been found necessary in tropical rice growing countries.

Phosphorus. The majority of recorded increases of any magnitude have followed the application of phosphatic manures alone or in conjunction with nitrogenous manures. In general, superphosphate or one of the ammonium phosphates has been employed; unit for unit, little difference has been found between the newer and older fertilisers.

Results in Different Countries.

Malaya. Routine applications of fertilisers in Malaya are strictly limited, the exceptions being in Kedah where considerable quantities of naturally occurring phosphates are said to be regularly employed and in Malacca where ground bones have been employed for many years; the results in the former case are said to be of great benefit, but no definite figures are available. As far as experimental work is concerned, fertilisers in Malaya have nowhere shown a great increase in yield. Even after making a number of unjustifiable assumptions in the working out of the results of experiments carried out over a term of years at Talang and Malacca, we find no significant increases at the latter, and only barely significant ones at the former Station—wherever increases of any kind occurred, phosphatic manures were concerned and at Talang the (theoretically) slow acting Perlis phosphates appeared to be, over a term of years, as efficient as the quicker acting artificials. In the few experiments which have been made with ammonium phosphates there are indications of considerable yield increases.

These experimental results form a curious contrast with those recorded in other countries where increases of yield of 70-100 per cent. are not uncommon and where ammonium phosphates have exhibited no signs of specific action. It is impossible to say how far the apparent success of trials in other countries is due to a tendency to stress successes and to minimise failures, but it is a fact that one recent paper devotes several pages to a successful experiment and dismisses two unsuccessful ones in two lines! Another frequent fault is the expression of yield increase as a percentage without giving actual figures; it is clearly most important that the datum line from which an increase occurred should be known.

Siam. The only recorded experiment* is with Leunaphos (ammonium phosphate) in which the smallest application used produced an increase over the unmanured control of 41 per cent. of grain and of straw; further increases of manure increased the straw to 64 and 69 per cent. but left grain increase unchanged.

Java. The best record of manurial experiments on tropically grown rice is to be found in Wulff's article in *Landbouw I* page 25 No. 2.

A few typical results will be quoted :— On Bantam Tuffloam, super and ammonium sulphate raised a yield of 730 lbs. per acre (say 140 gantangs) to 2,760 (say 530 gantangs). With fairly high controls on such soils (1,420 lbs. per acre) the increase was to a similar figure, i.e. the percentage increase was much less. On brown weathered laterite in Batavia no manure gave any increase on 4,700 lbs. per acre (900 gantangs per acre).

On a marl loam in Begogan there was clear evidence of the beneficial action of nitrogen in combination with phosphorus although the latter alone gave no increase over the control of 3,200 lbs. per acre (610 gantangs per acre) The nitrogen was here applied in 4 parts, at ½, 1, 1½ and 2 months after transplanting.

On brown marl loam there were divergences, no increase being recorded at Semarang over 1,950 lbs. per acre (375 gantangs per acre) with any form of manure, while at Grobogan a control of 3,300 lbs. per acre (640 gantangs per acre) was unaffected by nitrogen; raised to 4,900 (940 gantangs) by phosphorus or nitrogen and phosphorus and to 5,800 (1100 gantangs per acre) by a complete mixture: one of the few instances in which potash has done good.

In the Pate district on "gesek" soil (sandy and powdery when dry) a control of 700 lbs. per acre (135 gantangs) was raised by phosphorus to 1,350 (260 gantangs and by nitrogen, and phosphorus to 2,200 lbs per acre (420 gantangs per acre).

On clays results varied e.g. on a black clay at Madioen a control of 2,400 lbs. per acre (460 gantangs per acre) was raised to 3,000 lbs (575 gantangs.) by nitrogen and unaffected by phosphorus. At Ponorogo with a control of 3,000 lbs. there was no increase with any manure, while a similar soil in the same district with a control of 1,600 (310 gantangs) showed an increase to 2,600 (500 gantangs per acre) with phosphorus, other manures having no effect.

Wulff very frequently found that the maximum effect of nitrogen was obtained by application in two or more doses after the plants were transplanted ("overbemesting"). Although he does not say so, this seems to imply very complete water control.

Very interesting figures for nursery manuring are given, using manures in the nurseries at a rate four times that of field manuring (since the area of the nursery is 1/4 that of the field) it was found that in the Bantam district on tuff loams in one case no increase was produced, in another a control of 1,700 lbs. (325 gantangs) was raised to 2,100 (400 gantangs.) by superphosphate.

In a complex experiment on marl loam the following results were obtained:

* At the time of writing this paper.

No manure nursery	No manure Field	1250 lbs. p.a		(240 gantangs)
No " "	phosphatic "	3100	"	(595 ")
Phosphates " "	No manure "	2650	"	(510 ")
Phosphates " "	phosphatic "	3500	"	(670 ")

Similar results were obtained on a heavy clay with a control of 2,600 lbs. (= 500 gantangs).

These Java results have been quoted at some length, not with a view to direct application, but to show that :—

(a) even on soils chemically far richer than those in Malaya, large responses can be obtained;

(b) in a series of carefully recorded experiments numerous failures to secure response occur;

(c) no one manurial mixture will suit all soils;

(d) initial high yield is no bar to response.

Japan. In Japan, where yields have risen from 310 gantangs in 1885 to 525 in 1920, nitrogen rather than phosphorus or potash is found necessary.

The Japanese workers claim that lime is only useful if the magnesia content of the soil is high.

Burma. A good account of manuring in Burma has been given by Hendry in *Agric. Journ. India* XXIII p. 357 '28 and XXV p. 126 '30. At Hmawbi, experiments ran for 10 years, 5 years with manuring and 5 years without. The soil is obviously heavy as it is noted that green manures cannot be grown owing to the cement-like nature of the ground when dry. In the first paper, actual figures are not given—change being expressed merely as percentages.

Results obtained were.

	5 years manuring percentage change.	*5 years residual effect percentage.*
Cattle manure +30—70 lbs. N ...	40—70	21—31
Cotton cake ...	53	54
Bone meal } 20 lbs. P_2O_5	26	9
Superphosphate } 20 lbs. P_2O_5	35	15
Pot. sulphate ...	0	6
Sod. nitrate ...	17	35
Cyananide ...	11	64
Ammon. sulphate ...	24	25
Lime ...	24	2
Complete ...	33	17

Like all workers in India, Hendry is careful to translate these results in terms of money, an excellent idea which should be more widely followed. As an example, ammonium sulphate at pre-war prices with a 25-30 per cent. increase would have meant a loss of 5.5 Rs. per acre and in 1928 a gain of 2 Rs.

Experiments with ammophos (control = 240 gantangs), illustrate this point further—using 20:20 Hendry found 50 lbs. fertiliser gave an increased yield

of 48 per cent. an increased profit of 15 Rs. per acre.

100 lbs fertiliser gave increased yield of	68 per cent.	19	Rs. per acre increased profit.
200 „ „ „	103	11	„
500 „ „ „	119	24	„

Later experiments showed the following.

Manure		*Yields = lbs/ac.*	*G/ac.*	*Percentage Increase*	*Profit Rs.*	*Increase A.*
Control	...	1066	205	—	—	—
Diammophos	...	2098	405	97	15	7
Ammophos	...	2112	410	98	14	12
Super am. sulph.	...	2112	410	98	11	6

These results are of particular interest to Malaya as the new synthetic manures show no special manurial virtues; they also show the considerable increases required to produce good monetary return.

Hendry also makes the good point that the native cultivator must have quick returns especially when he has bought his manures with money borrowed at a high rate of interest.

Results in Ceylon, as far as available, vary with the soil type and need not be considered in detail.

Animal Manure.

The only countries in which manure of this description is extensively employed appear to be China and Cochin China. The Chinese are said to have rather a curious system of rotting down rice straw by making it into a compost with mud from the canal banks; the mixture is afterwards spread on the fields.

Green Manures.

There are singularly few descriptions of experiments on modern lines with green manures; in an article in the *Agric. Jour. of India 18 p.* 104,1923 the following results are given :— Control 1065 lbs. per acre (205 gantangs) green manure also or with a small quanity of apatite (mineral phosphate) gave no significant increase; green manure+740 lbs. apatite gave a rise to 1,400 lbs.; superphosphate or basic slag gave 1,500 to 2,100 lbs. The soils were poor and sandy. The Italians claim that green manures favour the action of phosphorus. Other workers in India stress the view that green manure is more effective on sandy than on heavy rice soils.

For manures, *Sesbania aculeata* is recommended in Ceylon while *Calotropis gigantea* is a favourite in Cochin China where, as in Japan and parts on India, the intensive collection of extraneous green matter is carried out.

Recent work by Joachim and Kandiah in Ceylon (*Trop. Agric. 72* p. 254) reviewed in the *Malayan Agricultural Journal* (Jan. 1930) gives considerable data on the decomposition of green matter in dry and wet padi soils both in the laboratory and in the field. Unfortunately, yield results were somewhat

spoilt by floods; in one case, taking the control as 100, early application of green manure gave an increase of 16 per cent. and late application of 30 per cent. The authors appear to be influenced throughout by the view that nitrates are deleterious to padi, a view in turn based on the very numerous observations of previous workers that sodium nitrate had frequently no manurial value and was often deleterious while sulphate of ammonia increased yields. This fact has been, until recently, ascribed to conversion to harmful nitrites (more than 5 parts per million of nitrite having been found to be harmful), to loss as gaseous nitrogen, to leaching and to inability of rice to assimilate nitrates. It was observed that application of sodium nitrate was frequently productive of chlorosis. Gericke as a result of his recent water culture work (v.inf) has give what seems the most probable explanation, which is that the residual alkali after removal of the nitrate radicle inactivates iron, and as rice has a great need of iron but can only very slowly assimilate it, chlorosis follows. This theory is confirmed by an observation of Willis recorded in *Jour. Agric. Research 24* p.621 25 to the effect that calcium nitrate did not cause chlorosis. Clearly if Gericke's view is correct, nitrates produced by nitrification should not be deleterious to padi although nitrification may be undesirable because of subsequent loss due to leaching.

The authors confirmed previous observations that only traces of nitrate and nitrite were present, but found considerable increases in ammonia—typical results for mbrs N as NH_3 percentages were:—

	Before puddling.				*After puddling.*					
Time in weeks	2	4	6	7	1	3	5	7	9	13
Control*	2	2.1	3.0	3.23	1.22	1.73	1.31	1.05	.91	.73
Green manure late					2.69	4.79	4.30	1.87	1.69	.87
Green ,, early	3.4	3.7	5.2	5.8	1.85	2.13	2.13	1.36	1.16	.83

Weeds gave results very similar to the green manures and total nitrogen figures were:—

		Initial N per cent.	*Final N per cent.*
Control	...	.1895	.1791
Green manure early	...	.1971	.1801
Green manure late	...	.1885	.1939

They further claim that in pot experiments with green manures, appreciable quantities of gases were given off after the second week from soil to which green matter had been added, but not from the controls and that the scum on the surface said by the Indian workers to be responsible for aeration had increased. They therefore claim better aeration for the padi roots. This claim must remain questionable until the evolved gases have been analysed; if they are poor in oxygen (which is highly probable) it is difficult to see, even with increased algal action, how aeration beneath the surface can be increased, as the tendency should be to sweep oxygen out and upwards.

Work in our soils laboratory on rice soil atmosphere has been started and these points will be tested. While the balance of evidence is in favour of the conclusion drawn by Joachim viz. that green matter should be turned in late,

further work is needed both in the laboratory and field before definite advice can be given.

Lord in his review of manurial results (*Trop. Agric. 73 '29*) finds that the effect of green manuring varies with soil, in one case there was distinct evidence that a green manure was necessary for the action of artificials to be manifested.

The practice of "Rab" cultivation (described in the *Chemical Memoirs Dept. of Agric. India* II p. 180) in W. India is of interest. In this the top layer of soil from seed beds is mixed *in situ* with cowdung and leaves and burned before sowing, giving increased fertility of 150 per cent. The action has been attributed to flocculation, but gypsum which also flocculates, gives an average of only 25 per cent. The analogy to the beneficial effect found by Russell to result from moderate heating of temperate soils is suggestive. This beneficial effect is generally attributed to reduction in numbers of protozoa with a consequent increase in numbers of beneficient bacteria, which are prayed on by protozoa.

Field experiments showed that a seed bed burned with—

Cowdung rab	will	plant	2.4	times the	area of	untreated.
Branches	,,	,,	2.1		,,	,,
Grass	,,	,,	1.1		,,	,,
Cowdung alone		,,	1.3		,,	,,

Drainage.

Perhaps the most perplexing feature of rice literature is the insistence on the need for "drainage", which appears to be somewhat loosely used for (a) the changing of irrigation water and (b) drainage in the usual sense of water movement downwards; most writers making drainage a *sine qua non* for the successful growth of the rice plant on the grounds that otherwise harmful acids will accumulate and/or the roots will lack necessary aeration.

There are many padi fields in Malaya in which there is little circulation of irrigation water and the majority (in area) can exhibit remarkably little subsoil drainage; further in the case of padi fields which are never reallv dry, conditions may be expected to be always definitely anaerobic. Yet these fields produce year after year very reasonable yields of padi. Clearly further work on drainage, soil atmosphere and soil flora is indicated.

The Work of Gericke on Water Cultures.

Perhaps the most interesting piece of research in connection with rice in recent years has been that of Gericke of which a brief resumé follows :—

Gericke has been studying for some years the combination of salts giving best growth in water cultures, the time in the life history of the plant at which absorption of any particular element occurs, and the effect on growth of the absence of certain elements. His most recent paper (*Soil Science 29 '30*) deals with rice. The method is one worked out by him in which the plants are grown for a definite period in a complete solution, then transferred to a solution lacking one so called "essential" element. In favourable cases he obtained plants as

large, heavy and healthy as those in a high yielding field, but failed to obtain with rice correspondingly large grain crops. The failure is attributed by him to pollination difficulties. He found that potash, nitrogen and iron are required for a much longer period than the other elements, in fact almost throughout life, but that calcium, magnesium, sulphur and phosphorus do not seem to be needed after initial exposures of 4—6 weeks; from this he draws the conclusion that the former are the essential elements for rice. It is equally possible to argue that since the elements of the second group must be or are normally absorbed in a very short space of time they must be presented to the plant in an available form in considerable quantities or conversely that as the absorption of the first group is spread over a long period they can be more readily foraged for.

It must be realised that these experiments, conducted as they are in water culture, may not give a true picture of happenings in the soil—this work is, however, suggestive in the light of Wulff's nursery manuring experiments.

It is interesting to note that Espino working in the Philippines with water cultures (*Phil. Journ. Science 16* p.460 '20) claims to have found that a very high relative proportion of magnesium is necessary for successful growth. This, if confirmed, would be most important in Malaya on our (generally) magnesium poor soils. The point is being tested in the new standardised padi experiments.

Padi Roots.

Although not strictly a soil problem, a recent paper by Sethi in *Memoirs Dept. Agric. India Bot. Series 18* No. 2 '30 is of interest. He claims as the result of studies in pot culture and in the field—

(i) That two types of roots can be observed (a) thin, brown flaccid branched roots (b) bold, white, almost unbranched.

(ii) That root system becomes weak and flaccid at flowering.

(iii) That root development shows distinguishing diagnostic characters for each variety which could be of help in the selection of varieties suited to particular localities.

(vi) The texture of clay seems to suit root development better than that of other types of soil.

(v) Anatomical observations confirm various views that rice is not strictly an aquatic plant, but that aeration is absolutely essential.

The importance of (iii) is self-evident and it is suggested that work on local varieties might be of considerable importance.

Conclusions.

Soils. It has been shown that padi is commercially grown on a large variety of soils and that *given water* there seems no reason to suppose that many areas in Malaya could not be profitably employed which normally are considered to be on the light side. The point is being tested on the padi tanks at the Experimental Plantation, Serdang.

Manures. The results quoted show that increases are not invariably to be obtained even on the same soil type; so far, no satisfactory explanation is forthcoming of many of the differences of response observed.

It is urged that the monetary return be always given a prominent place in the records of trials, and that a large margin of safety be established before recommendations are made to the rayat.

The effect of especially careful cultivation of Test and Demonstration Plots should be considered. It is urged that the final tests or demonstrations should always be made with the standard of cultivation current in the District. If it is desirable that the standard of cultivation be raised, it is suggested that this should be the subject of a separate campaign.

The questions of nursery manuring, the application of nitrogen by instalments*, green manuring, the use of cheap naturally occurring but slow acting manures and the use of basic or neutral instead of potentially or actually acid manures on Malayan soils require study.

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* A publication just received from Indo-China (*Bull. Econ. de l'Indo-Chine* 33 4B) shows that the application of nitrogen by instalments is practised there.

Extracts.

PREVENTION AND TREATMENT OF STEM-ROT OF OIL PALMS

BY

A. THOMPSON.

Acting Mycologist.

The following article is extracted from a Special Bulletin entitled "Stem-rot of the Oil Palm in Malaya" by Mr. Thompson, which is now in the press. The importance of the information contained therein and the need for its early dissemination, accounts for the publication of this extract.

Prevention.

Since it is considered that the sources of infection are to be found in the jungle stumps and fallen timber left after the jungle is felled previous to planting, it is desirable that such timber should be removed as soon as possible. The cost of doing this is the main consideration. Cleared land, however, possesses advantages which might be offset against the original cost. Drainage, and cultivation if necessary, are more easily accomplished; weeding costs are reduced and harvesting and transport are accelerated. Furthermore, the danger of white ant damage is much less. It is, perhaps, premature to advocate such a policy, but up to the present no signs of stem-rot disease have appeared on any of the oil palms growing on the Government Experimental Plantation, Serdang where the land was cleared of all timber before planting. Some of these palms are now eight years old. If the timber is not cleared, it is advisable to inspect it for fungus fructifications, and to destroy any which are producing frutifications of the fungi mentioned above.*

It is difficult to clear timber from peaty land and there is always a risk of a serious fire if the timber is burnt without careful supervision.

It is advisable to clear before the palms grow too big, since the expense will be greater if the palm leaves have to be tied back and shielded when burning the piled timber.

Protection of the freshly cut tissue of the leaf bases after pruning is the next consideration. It has already been mentioned that, when pruning, the next growing leaf is usually wounded by the pruning instrument. Consequently, any protective covering applied to the cut surface of a leaf base should also be applied to the wounds on the leaf above. It is customary on estates to use either an axe or a "parang" (a heavy knife with a blade about two inches wide and over a foot

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* Species of *Fomes* and *Ganoderma.*

in length) as the pruning instrument. While these instruments are preferred by the labourers and are said to be more efficient for use in harvesting on tall palms, the writer advises the use of a broad-bladed chisel and mallet for pruning the lower leaves of young palms not yet in bearing. These lower leaves are very difficult to prune without wounding the other leaves and under these circumstances a chisel and mallet are easier to handle than an axe or parang.

Numerous preparations have been tried as protective coverings for freshly cut tissue. The properties required in a cover are durability and cheapness. The water-miscible preparations such as Agrisol and Izal, were not found suitable, since they are easily washed away by rain. Furthermore, it was found that freshly cut palm tissue may develop gaping cracks a few days after pruning and also following the application of disinfectants, including those non-miscible with water, such as Solignum, Brunolinum and Dougalite. Coal tar had a similar effect, and a locally produced wood-tar which had the merit of cheapness, had a rather vigorous action on the tissue and did not appear to give a permanent cover. Various anti-corrosive paints, and certain chemical compounds e.g. Basilith, were also rejected either through not giving a lasting cover or on account of expense. Trials with Asphalt (D.X.) mixed with various oils gave promising results, and what appears to be a suitable covering has now been obtained.

If the mixture is sufficiently thick it forms an elastic and waterproof covering. Leaf bases treated with a mixture of Asphalt approximately 65 per cent. and Kerosene 35 per cent. were examined after eight months and it was found that the covering was unaltered. The mixture had penetrated only very slightly into the tissue which was sound.

Another mixture which has given good results is Asphalt 65 per cent. and Solar Oil 35 per cent. (approx). The latter mixture is cheaper at present prices, and costs about 33 cents per gallon as compared with Asphalt and Kerosene oil mixture which costs about 46 cents per gallon.

The late Mr. H. Sutcliffe of the Rubber Research Institute of Malaya carried out tests of similar mixtures, and stated that they are suitable for wound treatment on rubber trees * He gives the following formulae for treatment of Pink Disease * :—

(1)	Asphalt (D.X.)		40 lbs.
	Kerosene oil		3 gallons
	Brunolinum		40 ounces.
		Cost =	53.1 cents per gallon.
(2)	Asphalt (D.X.)		40 lbs.
	Solar oil		4 gallons
	Brunolinum		40 ounces.
		Cost =	35.4 cents per gallon.

* Sutcliffe H. The use of Asphalt and Bitumens on Estates". *Quart. Journ. Rub. Res. Inst. Malaya* Vol. 2., No. 3., November 1930.

The cost of the treatment on oil palms is not easy to estimate since the cost of labour must be considered in addition to the cost of the materials and the number of leaves which would be pruned per palm per acre. On one young estate is was found that 1 gallon of the Asphalt and Kerosene mixture was sufficient to treat the freshly pruned leaf bases of 27 palms from each of which about 18-20 leaves had been removed. During normal harvesting between 8 and 12 leaves are removed per palm per annum so that as a rough estimate 1 gallon of mixture should be sufficient to treat somewhat less than 1 acre of palms per year, reckoning 55 palms to an acre. If the figure for labour is not included, the cost of the treatment on palms in bearing would be about 40 cents per acre per annum if the Asphalt and Solar oil mixture is used. With regard to labour costs, the extra time required to carry out the treatment properly should not delay the pruning labourers very much once the work is organised.

The covering should be applied as soon after pruning as possible, especially in wet weather when *Thielaviopsis* is active.

The labourers should be instructed to apply the cover only to clean white tissue. Any decayed spots exposed by pruning should, if possible, be removed by pruning lower. Any wounds in the leaf above, or splits in the side of a leaf base, should also be covered.

During very wet weather, when rain falls heavily in the afternoons, it is advisable to see whether the covering has been damaged before it has had time to set. It would be advisable in the wet seasons to add a small amount of Brunolinum, Solignum or Dougalite to the protective cover, if heavy and continual rain is experienced.

Treatment.

It is possible to treat diseased palms successfully, but the work must be done thoroughly as otherwise re-treatment will probably be necessary. The work is costly, but if a large percentage of palms are found to be diseased, many of them can be saved if the disease is discovered in an early stage.

Since there are no very obvious signs that a palm is diseased until the rot is too far advanced for treatment, it is difficult to determine whether a palm needs treatment. Coolies experienced in the work can often find infected palms by striking the old leaf bases during a round of inspection. A healthy leaf base gives a firm hard sound when tapped, while a diseased leaf base gives a dull hollow sound, and can sometimes be pulled away from the stem. Suspected cases should be examined, and if the rot in the leaf base resembles the typical rot, the stem should also be examined. In some cases the stem will be found to be sound, but in others the tissues may be rotted to varying depths. If the stem is cut and found to be healthy, the cut should be covered with a little Asphalt, Oil and Brunolinum mixture, to prevent subsequent infection.

If the stem is found to be diseased, further inspection will reveal whether treatment is possible or the disease is in too far advanced a stage. Sometimes the disease attacks only one side of a palm, and sometimes it is found on both

sides. Palms have been treated when the stem was half rotted through on one side and after a year have been found to be still sound. The treatment of such advanced cases, however, is not recommended because it is probable that, when the palms grow taller, the weight of the crown will cause the stem to crack at the point of treatment, if much of the stem tissue has been cut away. Badly infected palms should be cut down, cut into pieces and burnt, or buried, and a trench should be dug around the "grave" in case trouble should later arise in the roots of adjoining palms. This is at present considered to be unlikely. The writer favours burying as opposed to burning, since it is difficult to burn diseased tissue, and fructifications of *F. pachyphloeus* (?), and *G. lucidum* have been found in profusion on a half burnt stem, a few months after it was burnt. The spores from these fructifications may cause infection in neighbouring palms and should not be allowed to form.

If the disease is in an early stage, further extension of the rot can be prevented by excising the rotted tissue until only healthy, white tissue is left. A protective covering should be applied. Asphalt and Oil mixture has given satisfactory results as a cover, but it must be applied thickly. The inner palm stem tissue, if exposed, does not harden or form new tissue, thereby differing from woody trees like rubber trees. Consequently, an artificial "bark" must be provided, if the leaf bases are entirely removed. In nature, an oil palm will form a hard stem, since defoliation is natural though slow, and even when artificially pruned, either the leaf bases harden and persist for a long time if not diseased, or they slowly disappear leaving a hard rough stem.

A covering which flakes off, or which causes cracking of the inner stem tissues, is not much good. Asphalt and Oil mixtures, however, are remarkably persistent if thickly applied and if allowed to "set" before being damaged by rain.

In wet weather it is advisable to add Brunolinum or a similar product to the mixture, on account of the danger from *Thielaviopsis* mould.

The treatment adopted when the disease first appeared, was excision of diseased tissue followed by painting with 25 per cent. solution of Agrisol or 3-5 per cent. solution of Izal. The palms were left for a week until the stem tissue had dried somewhat, and the tissue was then covered with Coal Tar. It was found, however, that further cracking occurred. and a second coat of tar was required. Also, in wet weather, *Thielaviopsis* mould attacked the tissue within twenty-four hours if heavy rain fell, and the tar did not give a good cover.

A certain amount of bleeding sometimes occurs at the edges of the Asphalt cover and the sap may flow down over the cover in streaks, which turn yellow. *Thielaviopsis* sometimes grows on this sap, but the mycelium does not penetrate through the cover, and has not been noticed to penetrate at the edge. It is, however, advisable to apply the Asphalt cover well beyond the edges of the exposed tissue.

If treatment cannot be supervised, the coolies are liable to leave spots of disease in the stem tissue, especially if they are given a "task" in a bad area.

Treatment is expensive, if much diseased tissue has to be cut away, and there is always the possibility that a fresh infection may start later above or below the treated patch.

It would perhaps be preferable to cut back all the leaf bases on a treated palm until clean leaf base or stem tissue is exposed and covered with the mixture, but the cost of doing this is excessive, owing to the labour involved.

It is not possible to give final recommendations as to the advisability of treating palms now in bearing until further information is available. At present, the price of palm oil is low and the margin of profit is not great. Treatment of diseased palms is possible but is expensive. On one estate a large number of diseased palms have been saved by treatment, but it is as yet not known whether the younger estates are likely to be affected by the disease to the same extent. Preventive measures can, however, be employed and are not unduly expensive if adopted on the younger properties not yet in bearing.

CATTLE FEED FROM RUBBER SEEDS *

Experiments have been carried out for several years in different parts of the world on the extraction of oil from rubber seeds and the use of the cake for feeding cattle. Lately a new industry has grown up in the United States of America where the high cost of linseed has caused manfacturers to look round for cheaper raw materials for the oil and oil-cake industry and the use of rubber seeds may be favoured by the low price level of rubber and related products.

In the organ for the American Department of Commerce, "Commercial Reports" this question was recently given prominence and a considerable amount of information given regarding the utility of rubber seeds which cannot fail to be of much interest to a country like Denmark which is a large consumer of oil cakes.

The seeds which have been utilized for the manufacture of oil and cakes are collected from rubber estates in the Dutch Indies and British Malaya. The production is calculated to be about 500,000 tons per year of which 300,000 tons are produced in the last named country, the balance in Java and Sumatra. The use of the seeds in the American oil industry is still in its infancy, as only 3,500 tons were exported this year, but it is expected that the export next year will exceed 10,000 tons.†

The seeds are treated in hydraulic presses and yield about 44 per cent. of oil and 50 per cent. of oil cake or meal while the loss is usually 6 per cent. The oil is utilized in the manufacture of soap, linoleum and paints. The oil shows on analysis to have practically the same composition as the oil from soya beans. The seeds are collected twice a year, usually in February and August.

The Effect on the Production of Milk.

The Polytecnical Institute of Virginia, together with the State Agricultural Experimental Station have completed a series of investigations on the value of the cakes of rubber seed for feeding cattle. These Institutes have stated that the cake must be considered a new valuable cattle food, rich in albumin and with a pleasant smell somewhat similar to cocoa cakes. It contains usually 30 to 34 per cent. albumin, 40 to 44 per cent. carbohydrates and 4 to 6 per cent. fatty substances.

The effect on milch cows with regard to their producing capacity has also been examined. The results show that the production of milk increased 10 per cent. when rubber seed cake was used for feeding instead of linseed cake. The content of fatty substances in the milk was also increased.

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* The following is a translation of an article by H. Hansen, Divisional Manager, Teluk Merbau Estate, Sepang, Selangor which was published in the Danish daily newspaper *Berligske Tidende* of 3rd October, 1930.

† The Company responsible for exporting rubber seed from Malaya for this purpose has now ceased operations. The export of seed is now negligible.

It should be understood that the production figures given above refer to the estimated yield of seed. Much of this seed, however, would be too costly to collect and market. *(Ed. M. A. J.)*

Reviews.

Guide to the Government Experimental Plantation, Serdang.

Department of Agriculture, S.S. and F.M.S. 139 pp, Index, 12 plates, 5 plans. Price $2/- post free (Straits Settlements Currency). 1931.

The Staff of the Agricultural Division of the Department of Agriculture, S.S. and F.M.S. are the authors of this Guide to the Government Experimental Plantation, Serdang, Selangor.

The Plantation was inaugurated ten years ago. During this period its development has been steady and its work has become widely known and appreciated not only in Malaya, but also in other parts of the world.

The increasing number of visitors to the Plantation has made it desirable to publish a guide which will give a summarised review of the different lines of progress of the principal activities of the station.

The Guide contains a review of 165 crops that have been investigated, in addition to more detailed accounts of the factories and machinery and the stock farm.

The arrangement of the book into eighteen sections, the variation in type for names of crops and the provision of an adequate index renders it possible for the reader to refer to any subject without delay.

The volume will therefore be of particular assistance to visitors to the Plantation, but should also be a very useful book of reference for planters. While it is difficult to select any one section as meriting special mention, the reviewer is particularly impressed with sections 13 and 14 which deal with fodder grasses, and cover crops and green manures, respectively, in the compass of nineteen pages.

The references enable the visitor to the Plantation to locate any crop he desires to see, while throughout the book are frequent references to publications of the Department which will enable the reader to amplify the information available concerning any subject treated in the Guide.

The book contains an account of a vast amount of useful work, the full scope of which can only be adequately grasped when it is viewed as a whole; together with valuable information concerning many existing and possible new crops.

It is understood that although the Guide is not one of the Special Bulletins of the Department, a copy will be sent to every annual subscriber to the Special Bulletins of the Department of Agriculture.

D. H. G.

Farm and Industrial Tractors.

BY

D. N. Mc. Hardy.

Crossley Lockwood and Sons, London, 1930.

This book, which contains 16 chapters and 234 pages, describes the wide range of uses to which tractor power can be put and should assist the owner and driver to get the best out of the tractor under their charge. The book is written, as far as possible, in non-technical language and is well illustrated, it can therefore be easily understood with little or no previous experience.

The first two chapters of the book deal with the early development of the tractor and the results of tractor trials carried out in Great Britain. The first application of mechanical power to direct traction on the land was steam and several types of steam tractors have been designed, but their greatest drawback was weight per horse power. Later, the internal combustion engine-tractor was designed, but although they only came into prominence during the period of the Great War as a result of the abnormal conditions prevailing, pioneer designers had been at work for many years previously. The demand for their products had not, however, been great enough to bring them into prominence. War time needs brought hosts of tractors to the fore, but some were of very imperfect design. The early designs were too heavy and at the Highland and Agricultural Society's trials in 1917 it was found that the light tractor provided with spuds on the wheels gripped the ground and performed its work better than the heavy machine. Great improvements in design and efficiency took place between the time of the Lincoln trials in 1919 and the Shrewsbury trials in 1922. Nearly all the machines exhibited at the latter show weighed less than 40 cwts. The Committee's opinion at the Shrewsbury trials was that a minimum of 25 B.H.P. was desirable for a general purposes tractor on the farm.

Having dealt with the early history and trials the next ten chapters are devoted to the internal combustion engine, giving details of construction and the working of the various parts. Valve operation, fuels and carburation, ignition, lubrication, cooling systems, transmission systems, chassis design and running gear are all dealt with and are adequately illustrated.

The crude oil engine tractor is described and its advantages and disadvantages are discussed. Hitherto, the chief advantage of this type of tractor has been its great weight per horse power, but this has been largely overcome. It also costs more to manufacture than the normal petrol or kerosine oil tractor engine and has not yet been proved sufficient by mature experience. The advantages of this type of engine are that no magneto, sparking plugs, or carburettor are necessary, these being replaced by automatic fuel pumps. For light loads the fuel admitted is reduced and for heavy loads is increased, the result being an engine which is nearly as flexible as a steam engine. It is economical in fuel consumption, using

less per break horse power than petrol or paraffin engines, and in addition, the fuel is much cheaper.

Chapter XII is devoted to the driving of the tractor and the next two chapters deal with the maintenance and possible sources of trouble.

The organisation of farm work, ploughing, tillage, drilling seeds, haying and harvesting, belt work, farm haulage and the costs of these operations are all dealt with in separate chapters. The last five chapters are devoted to horticultural tractors, industrial types, trailers and equipment and some industrial uses to which tractors can be put. Specifications of leading makers of tractors on the British market are contained in an appendix.

The book is well illustrated and indexed and should prove useful to tractor owners and drivers generally.

J. L.

The following Ceylon Sessional Papers have recently come to our notice and may be of interest to agriculturists in Malaya.

> Annual Report of the Board of the Tea Research Institute of Ceylon for 1928—Sessional Paper VI—1929, price 10 cents. Report of the Board of the Tea Research Institute of Celon for 1929—Sessional Paper VII—1930, price 10 cents. Report by the Economic Botanist on a visit to Malaya, Indo-China, Sumatra and Java, March—May, 1929—Sessional Paper XXXVII 1929, price Re, 1.15.

These may be purchased from the Government Record Office, Colombo at the above-stated prices.

Miscellaneous Articles.

ENTOMOLOGICAL NOTES.

First Quarter, 1931.

The introductions of parasitic or predaceous enemies from one country to another to control the same or a related species of insect have increased considerably during recent years and the advisability or otherwise of introducing one or more enemies of a pest, since one parasite may reduce the efficiency of another, has received attention amongst entomological workers in the biological control of insects.

In a paper on " The Insect Pests of Coconuts " which was presented to the Delegates to the Inter-Departmental Agricultural Conference in October, 1930, the writer stated that the Tachinid, *Chaetcxorista javana* B.B., would not appear to be such an important enemy of *Parasa lepida* as of *Setora nitens* and mentioned that the Braconid, *Apanteles parasac* Rohw., was a more evident parasite of the caterpillars of *Parasa lepida.* The predominance of *Apanteles parasae* over *Chaetexorista javana* appears to be due to the development of the former at the expense of the latter as the following observations illustrate. The writer in March collected from the nipah palm, three caterpillars of *Parasa lcpida,* on the ventral surface of which *Chaetexorista javana* had deposited numerous eggs. An examination showed that most of the eggs had hatched and the presence of several maggots of *C. javana* within the caterpillars. One of these caterpillars was dissected when abount 50 grubs of the Braconid, *Apantclcs parasae,* were also found. Grubs emerging from the other two caterpillars spun their whitish coloured cocoons from which *Apantclcs parasac,* in one case 26, emerged.

The above illustrates super and multiple parasitism and would appear to suggest that the introduction of *Apantcles parasac* for the control of *Parasa lcpida* or a related Limacodid should only be considered.

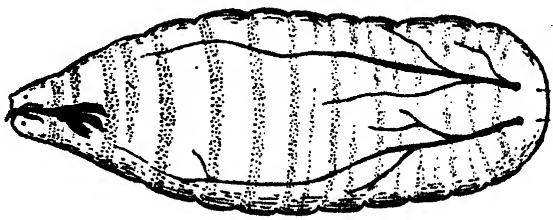

FIG. I.

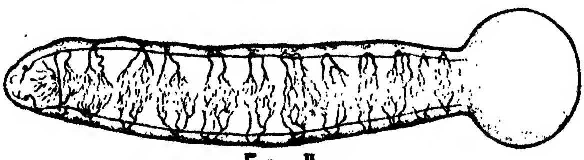

FIG. II.

Fig. I. Maggot of *Chaetexorista javana* B.B., Fig. II. Grub of *Apanteles parasae* Rohw.

Both larvae dissected from the same caterpillar of *Parasa lepida.*

Seasonal Occurrence of Insects.

Several reports of outbreaks of insects have been received and observations extending over some years indicate that numerous insects in Malaya are prone to increase to large numbers towards the end and the beginning of the year.

The prevalence of some insects at certain times of the year would not appear to be connected with a quiescent period but largely to the adverse influence of climatic conditions on the controlling parasites.

The more important reports were as follows:—

Cephonodes hylas L.—the Coffee Hawk Moth—may be collected from coffee and *Gardenia* throughout the year but for some years between January to March it has been reported causing extensive defoliation of coffee plants. This year it has been prevalent on coffee areas in Selangor and if regular inspections of areas were made during the beginning of the year and, on the appearance of this moth, control measures immediately instituted, much damage could be prevented. Towards the end of an outbreak a parasite, which parasitises the eggs of the hawk moth, is common and undoubtedly is the responsible factor for terminating outbreaks.

Four leaf-eating caterpillar pests of coconuts, viz:—*Hidari irava* (The coconut skipper), *Mahasena corbetti* (The " Case-worm "), *Setora nitens* (a nettle caterpillar) and *Amathusia phidippus* (The two-horned caterpillar), have been reported, all more than once.

The habit of *Tiracola plagiata* migrating from secondary growth to cultivated areas, generally rubber and tapioca, has previously been observed on numerous occasions. A report of its migration from secondary growth to young rubber was received during February.

Valanga nigricornis—the large greenish yellow coloured short horned grasshopper— several times during the quarter has been recorded injuring rubber.

Mimosa (*Mimosa pudica*) is probably the chief host of the Lymantriid caterpillar, *Orgyia turbata*. This insect is frequently prevalent towards the end and the beginning of the year. The appearance and habits of this insect were described in 1927* soon after its habit of migration to rubber had been recorded. The female of this moth is wingless and therefore its spread is due to the caterpillar. This may be prevented by spraying with lead arsenate a strip around the attacked area, thus forming a poison barrier.

With the exception of *Valanga nigricornis*, adults of which may be collected at any time, the above named insects pass through several generations during the year and heavy rains, occurring from about September to the end of November, would appear to be responsible for destroying their parasites, thereby allowing these pests to multiply without restriction.

The Cicadid—*Dundubia vaginata* F.—which causes so much annoyance by entering bungalows at night during February and March has a yearly life cycle

* *Malayan Agricultural Journal,* Volume 15, pages 240—255.

and its appearance, as the insects enumerated above, is not influenced by climatic conditions.

Copra.

The inferior appearance of copra is due in part to the attacks of insects and if more care were exercised a considerable amount of damage could undoubtedly be prevented.

Badly damaged copra was found on two occasions to be due entirely to the employment of old rice sacks containing a variety of insects. If such sacks are used they should receive careful attention and before filling with copra should be rendered insect-free.

Miscellaneous.

The bindings and leaves of books are often damaged by insects, especially the beetle, *Lasioderma serricorne* F. Books in cases fitted with wire gauze keep better than in closed book cases.

A mixture in general use for the preservation of books is composed of the following substances:—

Corrosive sublimate	1 oz.
Carbolic acid	1 oz.
Methylated spirits	1 quart.

This mixture is applied from time to time to the binding of books by means of a fine brush.

G. H. C.

HALF YEARLY REPORT ON COPRA RESEARCH WORK FOR THE PERIOD ENDING 31st DECEMBER, 1930.

BY

F. C. COOKE,

Assistant Chemist for Copra Research.

Nut Harvesting and Fruit Storage. Large scale experiments have been conducted on six estates to determine the correct time to harvest nuts so as to obtain the highest oil and copra yield per nut. It has been found that the highest yield is obtained when nuts are ripe and brown, and commencing to fall naturally, and contain an "apple" of about 1 inch diameter.

There does not appear to be much advantage in storing nuts previous to drying.

Copra Drying. Small scale experiments have shown that the percentage oil content as determined by ether extraction declines when coconut meat is dried under a variety of conditions although no volatiles appear to be evolved. Grated copra, in particular, very readily turns yellow and shows a markedly decreased oil content. This has been demonstrated both on an industrial scale and in the laboratory. Further work is in progress.

A design has been prepared for an experimental kiln of the Ceylon type to be installed at the Klang Experimental Station.

Coconut Charcoal. Renewed inquiries from England and the improved price now offered for this by-product has resulted in a further review of the situation with a view to its export.

Insects and Moulds. Heavily insect ridden copra from eleven world sources have been examined. After the copra was brushed clean of all adherent fibrous dust, the residual copra in most cases showed a normal oil content. The loss of dry copra was estimated to amount to half the original weight.

In conjunction with the Mycological Division, work on the study of copra moulds is proceeding and several pure cultures have been prepared.

Copra Baling. Further consignments of baled copra have been examined and the results have again shown that this method of packing neither causes oil loss nor exceptional formation of free fatty acids.

Copra of the lowest grade was also baled and after storage for 14 days in Malaya in open formation in a stack was ready for shipment to Europe, the moisture content having become reduced to the normal for exported copra.

Co-operation. The Peasant Produce Marketing Committee, which has been formed recently, is giving special attention to copra.

Agricultural Shows. A comparison of different types of inferior copra with high grade "F.M.S." copra has been the chief feature of the exhibits at five local

shows. Coconut products and correct nut harvesting were also demonstrated.

Ceylon Copra. A large number of Ceylon seed nuts have been examined and the results have shown that the Ceylon nuts as received here contain less but more oily meat than do typical Malayan coconuts. From information received, however, the Ceylon palms yield more of these small nuts per palm.

Copra Research Laboratory. Special accommodation has been provided and the new laboratory is now in running order.

Articles. Published in the *Malayan Agricultural Journal*:—"Coconut on Peat", "World's Coconut Crop". Abstract:—"Marketing Problems of Coconut Growers". Paper for Conference:—"The present day position of Copra Research and the practical application of the results".

Copra and Oil Palm Research Committee. The Assistant Chemist for Copra Research is acting as Secretary to this Committee and two meetings have been held in the past half year.

Departmental.

FROM THE DISTRICTS.

The Weather.

The weather throughout the month continued to be hot and dry with occasional showers in some districts, more especially towards the end of the month.

Remarks on Crops.

Rubber.—The local prices given for rubber from small holdings remained about the same as in February, being $10—16 for smoked sheet and $8—13 for unsmoked sheet.

Wintering continued, but was less uniform than that experienced in 1930. In some localities the new flush of young leaves was making good growth towards the close of the month.

The prevailing dry conditions exercised a noticeable check on the prevalence of Mouldy Rot disease and this fact, together with the enforcement of control measures, has caused a marked improvement in all badly infected areas.

Oidium Leaf Mildew was definitely reported to be present only in the District of Port Dickson in the Negri Sembilan. Up to the present it would appear to be much less prevalent than it was in 1930.

Padi.—Harvesting for the season 1930—31 was nearing completion in most parts of the country. It was noticed in Malacca that the crop was remarkable for the number of empty grains and reports were common that padi not attacked by any pest had yielded only half the crop normally obtained. It is feared that the crop in the Dindings will be almost entirely destroyed by draught.

Local prices for padi have ranged between 5 and 7 cents a gantang in most districts, except in the Negri Sembilan where they have varied from 8 to 12 cents and in parts of Perak South where they have also been as high as 12 cents a gantang.

Measurements of yields from trial plots of pedigree strains have been continued. In Kuala Lipis District of Pahang these strains gave yields varying from 400 to 760 gantangs per acre as compared with 320 to 480 gantangs per acre for local varieties. Pedigree strains also gave good results in Raub District of Pahang and in parts of Perak South where, for example, strain R 4 yielded 400 gantangs per acre as compared with 200—250 gantangs per acre from local varieties.

In Temerloh District of Pahang most of the nurseries were sown, but if the existing drought were to continue, it was feared that replanting would become necessary.

Efforts to popularise the pedigree strains of padi continue. In the Negri Sembilan the Padi Inspectors have attended the local weekly fairs with samples and have booked orders for seed. Other orders have been received as a result

of the Rural Lecture Caravan in parts of Seremban and Tampin Districts. A, demonstration was given on the Bukit Merah Padi Test Plot in Province Wellesley. This was attended by some 60 Malay padi planters and headmen who evinced keen interest in the work in progress.

The Padi Fly, *Leptocorisa* sp. occurred in large numbers in parts of the Central District of Malacca.

Coconuts.—The yield of coconuts in Perak South is reported to have fallen considerably, possibly owing to the draught in 1930. In Province Wellesley South a few seedling palms were attacked by the two coloured Coconut Leaf Beetle, *Plesispa reichii.* Control measures were undertaken.

Food Crops.—Large areas of land are being cleared in Temerloh District of Pahang for further planting with such food crops as Maize and Tapioca. The Malays living on the banks of the Pahang river undoubtedly realise the necessity and value of supplementing the very uncertain wet padi crop each year.

Fruit.—Heavy crops of guavas and limes were harvested in Lower Perak District, but prices were low, the former being sold at 3 or 4 fruits for one cent and the latter at 12—15 cents per 100. In Upper Perak District, durian, mangosteen, macham and other fruit trees were flowering.

Coffee.—In Batang Padang District of Perak a ready market in the town of Tapah for the locally grown Liberian and Robusta coffee has encouraged Malays to plant more of this crop where land is available. Local prices are 28 cents a kati for Liberian and 20 cents a kati for Robusta coffee. These compare favourably with prices in other parts of the country, for example 16 cents a kati in Temerloh District of Pahang. In the Dindings an outbreak of caterpillars of the Coffee Hawk moth, *Cephonodes hylas* on ten acres of coffee was successfully controlled by hand picking.

Tobacco.—A consignment of tobacco grown by a number of Chinese gardeners at Sungei Rambei in Province Wellesley and weighing just over 16 piculs was sold in Penang during the month for the encouraging price of $48 per picul. With a continuance of this price, gardeners are likely to extend the cultivation of this crop. Most of them have recently evinced a desire to try an experiment in planting the Deli type of tobacco, which, they claim, loses less weight in drying than does the Kedah type which they are now growing. In Perak South some Malay and Chinese cultivators are planting up this crop for the first time, while others are extending the areas previously planted. The types grown are mainly Javanese and Chinese. The price obtained for the dry leaves is about 30 cents a kati.

Notes on Demonstration Stations.

Pulau Gadong Padi Experiment Station, Malacca. During the month a pumping plant, consisting of a 3 B.H.P. Petter engine and a 4 inch by 3 inch Worthington Pump, was installed at this Station. The running of this plant is satisfactory and the output of water sufficient for complete irrigation of the whole Station.

Agricultural Exhibition, Malacca.

A collection of exhibits of local agricultural produce was staged in Malacca for the benefit of passengers on three tourists ships which arrived there during the first week of the month. The crops illustrated were rubber, padi, coconuts, oil palm, tapioca, tea, local fruits in season and local vegetables. The exhibition was well received and appreciated by the visitors among whom were a proportion of teachers and of business men interested in tropical produce.

School Gardens.

Work in these gardens was recommenced when the schools re-opened after the holiday for the fasting month and the padi harvest. Operations consisted chiefly of the cultivation and remaking of the beds in preparation for replanting.

Rat Destruction.

In Province Wellesley 225,232 and in Malacca 60,949 rats tails were collected during the month, the great majority being from very young animals dug out of the bunds in the padi fields where nests are numerous now that the main breeding season has commenced. In Temerloh District of Pahang, lectures on rat destruction were given in two mosques. Malay leaflets and supplies of barium carbonate were distributed in order to stimulate interest in rat control at a time when the padi nurseries are being sown.

DEPARTMENTAL NOTES.

Visit of H. E. The Governor-General of the Philippines.

His Excellency the Governor-General of the Philippines, accompanied by the American Consul-General for Malaya, the Secretary for Agriculture for the Philippines, the Secretary for Commerce and other members of the Philippine adminstration paid a visit to Kuala Lumpur on March 16th. His Excellency visited Sungei Way Estate during the morning.

In the afternoon Mr. Rafael Aluman, Secretary for Agriculture and Natural Reserves, Philippine Islands, Mr. Lester Mayrard, United States Consul-General Singapore and party visited Serdang Plantation and were conducted round the Station by the Director of Agriculture S.S. and F.M.S. and the Agriculturist.

The Director of Agriculture Visits Singapore.

The Director of Agriculture visited Singapore from March 8th. to 11th.

The Oil Palm Factory at Serdang.

The installation of the additional new machinery in the oil palm factory at the Government Experimental Plantation, Serdang, is now completed and will permit of useful and interesting comparisons being made between the centrifugal and press systems of palm oil extraction.

The installation of the Stork hydraulic press was completed in February. The press is now working satisfactorily.

The Laval Separator, which has been erected for the purification of palm oil, was also put in working order in February and as a result, a much cleaner sample of palm oil is now being produced.

It is hoped shortly to publish in this Journal a full account of the palm oil factory erected on the Plantation.

Rural Lecture Caravan.

The new propaganda caravan, organised by the Department of Agriculture, the Co-operative Department and the Rubber Research Institute of Malaya made its first visit to Negri Sembilan in March, visiting parts of the Seremban and Tampin Districts. The tour was a conspicuous success, the lectures and demonstrations attracting large crowds on each occasion. A full account of the caravan and of the work it is doing will be included in the next number of this Journal.

Demonstration at Serdang.

On 20th. March a party of Chinese attended a Demonstration at the Government Experimental Plantation, Serdang, being conducted round the Plantation by the Chinese Sub-Inspector of Agriculture.

As the members of the party were mainly interested in tea, the visit was almost exclusively devoted to the management of this crop and the manufacture of tea.

On this occasion special attention was directed to the area under Guinea grass, as trials have indicated its suitability as a food in fish rearing.

The party expressed appreciation of the visit. One Chinese gentleman expressed a desire to spend more time on the Plantation and was invited to make up a party of interested agriculturists from his district for the purpose of a further visit.

Staff Change.

Mr. H. J. Simpson took over the duties of Agricultural Field Officer, Perak South, from Mr. E. A. Curtler on 1st. March, 1931.

Leave.

Major C. D. V. Georgi, O.B.E. Acting Agricultural Chemist, returned from leave of absence on 12th. March, 1931.

Mr. T. D. Marsh, Assistant Agriculturist, returned from leave of absence on 19th. March, 1931.

Mr. E. A. Curtler, Assistant Agriculturist has been granted 8 months leave on full pay, with effect from 6th. March, 1931.

Statistical.

MARKET PRICES.

Rubber.—In spite of the slight rise in the price of rubber early in the month, the end of the month saw the commodity still weaker, the lowest price on record, 10¾ cents per lb. being offered on the Singapore market on the last two days of the month. The average price for the month was 12 cents per lb. Singapore, compared with 11.9 cents for February. The average London price was 3.8d. as in February: the highest price quoted being 4 1/8d. on 5th, the lowest 3 3/8 on 29th. and 30th. March.

Palm Oil.—London writing under date of 19th. February states that the market continues to decline steadily and the value on that date was not more than £14 per ton F.O.B. on a basis of 18 per cent. F.F.A.

Copra.—Owing to a temporary shortage of supplies, the price of copra in Singapore advanced during the first half of the month. Later the market tended to decline as supplies came in more freely. Average prices were: Sundried, $5.97 per picul; Mixed, $5.58 per picul, compared with $5.67 and $5.33 respectively in February. Copra cake has been quoted at $1.50 to $1.60 per picul, the average price being $1.58.

Pineapples.—The following are the average prices paid in Singapore per case of canned pineapples: 1½ lb. cubes, $3.28; 1½ lb. sliced flat, $3.14; 1½ lb. sliced tall, $3.42. A good deal of business was done early in the month for delivery April/May/June at very low prices. Later the market was quiet but steady with moderate business passing for forward delivery.

Tapioca.—The Singapore market has been quiet but steady. Average prices per picul for the month were: Flake, fair, $4.20; Pearl, seed, $5.25; Pearl, medium, $6.00 compared with $4.07, $5.06 and $6 per picul in February.

Sago.—Singapore average prices for March were: Pearl, small, fair, $5.75, Flour, Sarawak, fair, $2.44 per picul compared with $6.06 and $2.48 per picul in February.

Rice.—Local prices shew a further sharp decline during the month. The following are the average monthly prices in dollars per coyan during the present year.

	January	February	March
Siam No. 2	186	175	165
Saigon No. 1	176	161	154
Rangoon No. 1	156	148	139

Gambier.—Market remains featureless. Block gambier is quoted at a nominal price of $9.75 per picul while Cube No. 1 averaged $15.00 per picul in March.

Pepper.—There has been a certain amount of speculative buying on the Singapore market, but generally the market has been dull and easier. Average Singapore prices per picul for March were: Singapore Black, $21.00; White,

$38,50; Muntok White, $39.75. The February average prices were, respectively, $21.06; $36.88; $38.12.

Cloves.—Average Singapore prices in March remain unchanged at Zanzibar, $62 per picul; Amboina, $59 per picul.

Nutmegs.—Average prices in Singapore for the month were for 110 per lb., $23.37 per picul; 80 per lb., $27.75 per picul. Corresponding prices in February were $25 and $29.75 per picul.

Mace.—Average Singapore prices: Siouw, $79.75 per picul against $92.50 in February; Amboina, $59.50 per picul against $59.50 per picul in February.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports for March, and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd.

1 picul = 133 1/3 lbs. ... 1 coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57 Charing Cross, London, S.W.1.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF FEBRUARY, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	12,877	15,369	11,383	23,651	9,282	19,311	Nil	5	Nil	9	12,406	6,365	26,420	14,062	15,016	15,129	...
Johore	...	2,257	4,801	3,320	7,061	4,062	8,291	Nil	2	Nil	2	605	6,818	1,234	13,947	2,307	4,712	...
Kedah	...	463	2,671	1,957	4,453	1,031	2,400	Nil	Nil	Nil	Nil	565	2,787	1,266	5,866	364	2,406	...
Perlis	...	10	10	7	15	11	27	Nil	Nil	Nil	Nil	Nil	24	Nil	49	5	9	...
Kelantan ...	...	188	101	202	397	422	882	5	Nil	7	Nil	54	558	109	1,082	224	82	...
Trengganu ...		55	50	101	153	50	76	Nil	Nil	Nil	Nil	Nil	151	Nil	229	55	50	...
Total Malay States	...	15,850	23,002	16,970	35,730	14,858	30,987	5	7	7	11	13,630	16,703	29,029	35,235	17,971	22,388	...
STRAITS SETTLEMENTS																		
Malacca ...	...	3,365	1,664	1,118	2,330			Nil		Nil		5,260		10,439		3,518	1,658	...
Province Wellesley	...	133	663	414	924			Nil		Nil						118	564	...
Dindings ...	...	167	128	95	200	(2) 2,000	(2) 4,000	Nil	16,696	Nil						152	125	...
Penang	1,364	5,244	14	7	19			763		1,609	35,224	6,903	Nil	12,541	Nil	5,047	10	1,877
Singapore ...	4,740	33,293	299	175	368			7,194		15,337		16,158		31,521		34,151	311	3,301
Total Straits Settlements	6,104	42,202	2,768	1,809	3,841	2,000	4,000	7,957	16,696	16,946	35,224	28,321	Nil	54,501	Nil	42,986	2,668	5,178
TOTAL MALAYA	6,104	58,052	25,770	18,779	39,571	16,858	34,987	7,962	16,703	16,953	35,235	41,951	16,703	83,530	35,235	60,957	25,056	5,178

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	11,597	19,952	8,411	2,848	912	38,720
Crepe	686	10,288	1,127	723	171	12,995
Unsmoked sheet	1,637	3,911	509	217	668	8,594
Scrap and lump	1,096				556	
Total all Grades	15,016	34,151	5,047	3,788	2,307	60,309

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	26,048	51,795
Penang ...	11,425	21,540
Port Swettenham.	3,993	8,756
Malacca ...	490	1,439
MALAYA ...	41,951	83,530

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	33,477	66,552
MALAYA ...	33,477	66,552

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, *i. e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, the figure is an estimate based on the average found for the year 1930.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with the omission of certain explanatory notes, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on March, 20, 1931.

GENERAL RICE SUMMARY.

February 1931.

Malaya.—57,780 tons of rice were imported and 13,700 exported as compared with 75,962 tons for the corresponding period last year. Of the total imports 52 per cent. was from Siam, 35 per cent. from Burma, 11 per cent. from French Indo-China and 2 per cent. from other countries.

The average declared value of imports of rice into Malaya for the first two months of 1931 was $4.80 per picul as compared with $7.13 for the corresponding period last year. Retail prices were:—Singapore 35 cents, Penang 40 cents and Malacca 35 cents per gantang as compared with last year's averages of Singapore 50, Penang 52 and Malacca 50.

The Malayan padi reports for February show but slight increases in the areas planted over those published in the March issue of this Journal.

In most cases harvesting has been completed or is in progress. Field estimates are not yet available.

India.—The total area planted is reported as 81,986,000 acres—an increase of 1,507,000 acres as compared with last year. It is estimated this year's yield will be 1 per cent. higher than that of last year and the general condition of the crop is reported as good.

Burma.—The latest official forecast of out-turn amounts to 7,609,000 tons (Rice). This differs but little from earlier estimates.

Formosa.—This year's crop promises to be 7.2 per cent. over that harvested last year and 11 per cent. higher than the average crop of the past five years.

General.—Almost without exception, reports from all rice prdoucing districts show a greater area planted and higher estimate of yield for this season than for the previous season.

The following notes and tables will be of interest.

French Indo-China.—Entries of padi at the port of Cholon and exports of rice from Saigon from 1st to 31st January (*Chambre de Commerce de Saigon Bulletin Bi-Mensuel*) were, in 000 metric tons:—

1st to 31st January	1931	1930
Entries of Padi	49	123
Exports of Rice	51	93.

Ceylon.—Imports into Ceylon during January were (in tons):—

	From Br. India.	Burma.	Straits.	Others†	Total.
1928	8,325	23,991	5,809	894	39,019
1929	—	35,275	1,135	355	36,765
1930	10,811	35,792	125	2,268	48,997
1931	8,719	29,754	130	2,263	40,866

† Including the Maldive Islands, Cochin-China, India, Japan and Siam.

Siam.—Average wholesale Siam rice prices per ton in Singapore, were in dollars (Straits) :—

	1930	1931		Increase(+) or Decrease(—)% on previous month.
	Average Jan.-Dec.	January	February	
Singapore No. 1 ...	130	94	89	— 5.3
Singapore No. 2 (Special) ...	118	85	80	— 5.9
Singapore No. 2 (Ordinary)	108	76	73	— 4.0
Siam White Broken A. 1 ...	86	58	51	— 12.1
Siam White Broken C. 1 ...	81	55	48	— 12.7

The stocks of rice in Singapore, Penang and Malacca during the following periods were (in 100 tons) :—

1930				1931
September	October	November	December	January
25,730	17,678	13,492	22,691	15,854

Percentage Imports of Rice from different Countries during February, 1930 and 1931.

From	1930	1931	1931 compared with 1930.
	per cent.	per cent.	per cent.
Siam ...	56	52	— 4
Burma ...	37	35	— 2
French Indo-China ...	6	11	+ 5
Other Countries ...	1	2	+ 1
Total	100	100	—

Miscellaneous.—The following is an extract from the *Indian Trade Journal* of February 26, 1931 :—

" From the latest available bulletin published by the International Institute of Agriculture, Rome, it appears that the Estimates of the 1930—31 rice crop of the United States of America are 960,000 acres and 831,000 tons of rough rice, showing an increase of 11 per cent. in area and 2 per cent. in yield as compared with 1929—30 crop.

In Italy, the area and yield of rough rice are 360,000 acres and 641,000 tons, as against 339,000 acres and 663,000 tons in 1929—30."

METEOROLOGICAL SUMMARY, MALAYA. FEBRUARY, 1931.

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day Amt.	Number of days: Precipitation* .01 in or more	Precipitation, .04 in or more	Thunder-storm	Thunder heard	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent	Length of Day
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.							hr.	hr.	%	hr.
Railway Hill, Kuala Lumpur, Selangor ...	93.5	72.3	82.9	97	69	90	75	84.7	84.5	4.48	113.8	2.94	8	7	...	11	3		227.85	8.14	68	12.0
Bukit Jeram, Selangor ...	90.5	73.1	81.8	93	71	85	75	86.6	87.4	2.47	63.7	1.38	10	7	2	15	2		266.10	9.50	80	12.0
Sitiawan, Perak ...	91.8	72.6	82.2	94	70	88	76	85.2	84.5	4.69	119.1	3.58	5	4	5	10	1		257.20	9.19	...	...
Kroh, Perak ...	91.4	66.6	79.0	94	59	86	73	81.0	81.8	0.74	18.8	0.50	7	5	...	4	...		255.00	9.11	...	...
Temerloh, Pahang ...	90.3	71.6	80.9	92	67	85	76	85.1	84.6	2.07	52.6	1.64	4	4	...	7	12		230.85	8.24	69	12.0
Kuala Lipis, Pahang ...	90.1	70.6	80.3	93	67	83	73	83.5	83.3	1.96	49.8	0.61	8	8	1	5	13		221.30	7.90	66	12.0
Kuala Pahang, Pahang ...	85.9	74.9	80.4	88	71	83	79	84.7	84.3	2.87	72.9	1.30	8	6	1	4	...		258.90	9.25	...	12.0
Mount Faber, Singapore ...	90.4	73.8	82.1	92	71	88	76	81.4	82.0	5.91	150.1	2.35	10	7	3	5	...		199.10	7.11	60	12.1
Butterworth, Province Wellesley ...	90.4	73.6	82.0	96	71	87	77	85.9	84.7	1.26	32.0	0.33	9	9	1	9	...		284.70	10.17	...	...
Bukit China, Malacca ...	90.1	74.2	82.1	93	70	85	76	85.1	84.5	1.71	43.4	1.25	6	5	3	7	...		249.65	8.92	74	12.1
Kluang, Johore ...	90.9	72.3	81.6	94	68	87	75	82.7	82.3	0.96	24.4	0.43	7	5	1	6	2		218.15	7.79	84	12.1
Bukit Lalang, Mersing, Johore	85.1	74.0	79.5	88	69	84	78	81.3	81.0	2.40	61.0	0.84	9	5	...	1	...		242.40	8.66	72	12.1
Alor Star, Kedah ...	93.8	69.8	81.8	96	62	90	76	84.8	85.5	1.17	29.7	0.55	4	4	...	3	...		274.45	9.80	82	11.9
Kota Bharu, Kelantan ...	87.0	71.1	79.1	89	67	83	76	82.1	82.7	2.31	58.7	0.72	10	7	...	1	...		244.50	8.73	73	11.9
Kuala Trengganu, Trengganu	86.0	71.4	78.7	87	68	80	75	82.5	82.7	4.69	119.1	2.31	9	8	...	1	6		252.30	9.01	75	12.0
HILL STATIONS.																						
Cameron's Highlands, Rhododendron Hill, Pahang 5120 ft. ...	74.1	58.7	66.4	77	55	69	61	...	...	2.07	52.6	0.86	8	8	...	6	...		193.20	6.90	60	12.0
Cameron's Highlands, Tanah Rata, Pahang 4750 ft. ...	73.6	54.2	63.9	76	45	70	63	69.2	68.9	2.11	53.6	0.87	10	7	...	8	1		193.20	6.90	60	12.0
Fraser's Hill, Pahang 4268 ft.	72.8	60.9	66.9	78	57	68	64	71.7	71.5	7.61	193.3	2.66	11	11	...	6	17	2	189.30	6.76	56	12.0

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

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The Director of Agriculture (Chairman).
The Director, Rubber Research Institute.
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REPRINT.

A reprint has been prepared containing the following articles appearing in this number ;—

Editorials on rubber.
Review of F.M.S. Statistics Relating to Rubber Production in 1930.
Condition of Small Rubber Holdings in Malaya; first quarter 1931.
Translation of Sixth Report on Native Rubber Holdings in N.E.I.
Areas out of Tapping, F.M.S. & S.S. during the first quarter 1931.
Malayan Rubber Statistics for March, 1931.

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THE

Malayan Agricultural Journal.

MAY. 1931.

EDITORIAL.

The School of Agriculture, Malaya. Attention has been drawn, in a previous number of this journal, to the fact that the School of Agriculture will be ready for occupation this year. Considerable progress has recently been made in providing the necessary equipment, and it is hoped that students will be able to commence their training about the third or fourth week in May. A large number of applications has already been received, from all parts of the Peninsula, for admission to the School; the majority of these applications are for free tuition and maintenance, and for subsequent employment in the Department of Agriculture, while the number of *bona-fide* candidates for admission as private students is fairly satisfactory considering the present acute financial depression.

The time is opportune, however, for emphasising the fact that the School is intended primarily for the benefit of private agriculturists, and not merely for the training of Malay officers in this Department. The cultivation of crops by Asiatics in this country is commonly conducted along unscientific lines, while their methods of preparing and marketing agricultural produce are, in general, capable of considerable improvement. It was largely to remedy these defects that the provision of a School of Agriculture was first conceived; and now that the School is within a few weeks of being opened, it is most desirable that everyone—and particularly those engaged in local agriculture—should realise the facilities for improvement which can be anticipated from the training offered at the School.

Two courses of instruction have been carefully designed to meet the requirements of local agriculturists. It is intended that the Three Years Course should be particularly thorough in scope, offering theoretical and practical instruction not merely on the pure sciences which underly the art of agriculture, but also on the actual cultivation, preparation and marketing of crops suitable for production in Malaya. The One Year Course is necessarily restricted by comparison, but is essentially practical.

The outlets for private students who have completed their training at the School are two-fold: firstly, as responsible employees on the large estates,

secondly, as efficient managers of their own properties or of estates belonging to friends or relatives. The School diploma will stamp its owner as a man of definite attainments and agricultural training, and we see no reason why, in due course, young men holding this diploma should not find employment on European and other large estates in this country. It may, in time, prove desirable to create an Agricultural Appointments Board as a means of contact between post students of the School and prospective employers; but the creation and development of such an institution is obviously a matter, in the first place, for private enterprise. It is perhaps in the second direction, as managers of smaller Asiatic estates, that greater scope at present exists for absorbing private students on the completion of their training. Thousands of Asiatics are already employed in this manner; but, as we have already claimed, their knowledge and methods are capable of improvement in various directions. This improvement will be forthcoming to a considerable extent if Asiatic agriculturists will undergo a course of training at the School. It is largely for their benefit that the School has been erected; and they will learn that it is in their own interests, financially and otherwise, to avail themselves of the training now offered.

Rubber Statistics.

In this number, we publish an article, supported by graphs, on "A Review of the F.M.S. Statistics Relating to Rubber Production" by Mr. J. Gordon-Carrie. It is suggested that this article be read in conjunction with an article of a similar nature dealing with the 1929 statistics which was published in the *Malayan Agricultural Journal* of January 1930, and with the rubber statistics published monthly in this Journal since that date.

It is pointed out that a comparison of the production rates of small holdings and large estates for 1929 and 1930 shews a tendency for the production on large estates to increase and for that on small holdings to be less. The convergence of these graphs leads to the conclusion that at the end of 1931, the production rate on large estates and small holdings will approach very closely and that it is even possible that they will exchange positions within a year or eighteen months from date.

In this connection it is to be noted that the native rate shews wider and more frequent fluctuations over the periods reviewed than do the large estates so that the possibility of convergence of the two graphs or the date of such convergence is somewhat conjectional. Further, the tendency is for the production rate of large estates to increase more rapidly than that of the small holdings to decrease.

The point of convergence of these production rates, however, is of less moment than is the actual rate at which they converge. It seems to us probable that this point of convergence if indeed there be such, will be at a point above 500 lbs. per acre, which will mean that the low price of rubber has resulted in the adoption on large estates of systems of tapping which have not only lowered the cost of production, but have resulted in increased yields.

On the other hand, the economic situation, as the author points out, has led to excessive tapping on small holdings, the result of which he expects will decrease yield rates in the near future. The duration of diminished yields from small holdings is closely connected with questions of tapping systems and the rate of bark consumption. The yields in years subsequent to 1932 will therefore depend on such factors as rubber prices and tapping policy which cannot be forecasted at present. A close study of bark consumption and general condition of small holdings is at present being conducted by this Department in conjunction with the Rubber Research Institute of Malaya. It is hoped that the conclusions drawn from this investigation will enable a more accurate estimate to be made of the future production on small holdings.

In passing, we would draw attention to the non-effectiveness of the voluntary restriction scheme, known as the " May tapping holiday " as far as native production was concerned. This result rather emphasises the opinion that voluntary restriction of rubber production will never prove effective in view of the large share of production held by the small-holder.

Information on Rubber from Small Holdings.

Since the above Editorial was sent to the press, further important information has been received regarding rubber on small holdings in Malaya and the Netherlands East Indies, which induces us to re-open this column for additional comments on this subject.

In this number will be found two articles dealing with small-holding rubber in Malaya and the Netherlands East Indies. The article on the conditions of small-holdings in Malaya during the first quarter of 1931 has been written by the Field Division of this Department in consultation with the Statistical and Economic branches and with the Rubber Research Institute of Malaya. The second is a translation of the sixth report on native rubber cultivation in the Netherlands East Indies, covering the period from September, 1930 to March 18th., 1931 by Mr. A. Luytges, Chief of the Division of Agricultural Economics of the Agricultural Information Service, Netherlands East Indies. We are indebted to His Majesty's Consul-General, Batavia, for this important translation. The translation of the fifth report will be found in the *Malayan Agricultural Journal* of December, 1930.

Readers are thus placed in possession of the most recent available information regarding rubber production on small-holdings in Malaya and the Netherlands East Indies.

The factors which influence the production of rubber in Malaya and the Netherlands East Indies vary considerably. It will be noted that in Malaya the policy adopted has been and is, intensive tapping, while in the Dutch Indies, the considerable fall in prices last year resulted in decreased production of rubber from small holdings as the natives possessed alternative means of livelihood. It was anticipated that the amount of rubber exported would still further decline, but the experts have been compelled to revise their ideas on account of two facts,

one of a temporary nature and the other likely to be more permanent. The necessity of possessing ready money for the payment of Government taxes and for the Mohamedan festivals led to a renewal of tapping in many cases. But the more important factor has been that the native has adopted a lower standard of living which has resulted in a drop in commodity prices in rural districts by as much as 30—50 per cent. In addition, the activities of a processing company has led to a more economical system of exporting rubber.

From all these evidences, it would appear that, in spite of the low price of rubber, the export of rubber from small holdings will, at least in this year, be fully maintained.

In view of the importance of this subject and the anticipated demand for this information in a convenient form, we have prepared a reprint containing the following:—Editorials on rubber appearing in this number, Review of F.M.S. Statistics Relating to Rubber Production in 1930; Conditions of Small Rubber Holdings in Malaya, first quarter 1931; Translation of Sixth Report on Native Rubber Holdings in the N.E.I.; Areas out of tapping in the F.M.S. and S.S. during the first quarter of 1931 and Malayan Rubber Statistics for March 1931. In addition, the reprint will contain a typed table shewing the range of prices for small-holding rubber in various localities in Malaya. The price of this reprint is 25 cents per copy.

Mechanical Cultivation of Rice.

The interest aroused by the publication last year of two articles in this Journal on mechanical rice production in Southern Siam and in Australia has led to a more detailed study by Mr. J. Lambourne of the experiences gained in various parts of the world in this method of cultivation here summarised under the title "Mechanical Cultivation of Rice." We wish in this place, merely to reiterate our conviction that this method might be more widely adopted in this country; an opinion which is amply supported by its successful application in other parts of the world. These articles together with two book reviews on tractors should place at the disposal of our readers an adequate bibliography on this subject.

A Pest of Nipah.

We have previously given evidence that the pages of the *Malayan Agricultural Journal* are open to the public for the purpose of publishing articles dealing with research work of value to agriculturists in the tropics. On another page will be found an article on the "Life Cycle of a Fly Pest (Anthomyiid) on *Nipah fructicans*" by Mr. J. W. Sewill which provides further proof of our policy in this direction.

When the nipah plant was considered solely as a source of roofing material, a pest of the inflorescence was of little interest and without economic importance. But the utilisation of this plant as a source of power alcohol in a mechanical age such as the present, adds emphasis to the importance of this pioneer industry in Malaya. As the raw material for alcohol production is obtained from the spathes, a new importance attaches to such a pest as forms the subject of this article.

Original Articles.

A REVIEW OF F.M.S. STATISTICS RELATING TO RUBBER PRODUCTION

BY

J. GORDON-CARRIE,

Deputy Registrar-General of Statistics, S.S. & F.M.S.

In the *Malayan Agricultural Journal* of January, 1930, an article was published to which the present one is intended to be supplemental. The charts which illustrate this article are planned on the same lines as those that accompanied the article referred to above and continue production statistics from January to December, 1930. Attention is directed in particular to the following paragraphs of the previous article :—

" In general, the owners of holdings less than 100 acres in area do not hold rubber off the market but sell as they produce. There are, however, times when for a few days the sales are retarded : and when such times occur at the end of a month the total sales in that month are lessened by an amount which, almost always, goes to swell the total sold in the next month.

" For that reason the total production by holdings of less than 100 acres in any one month cannot be deduced directly from the statistics published monthly. These give, by the use of a simple calculation, the amount of the total sales during the month of rubber by such holdings.

" If, however, the amounts sold monthly are averaged over three or four months, the figure so arrived at gives the average rate of production during that period. Thus, by the simple process of taking averages over periods of that duration, each such period progressing by one month, it is possible to arrive at estimates of monthly production which are almost exact. (The margin of error is within an extremely small percentage.)

" Another factor of some importance is that crops harvested monthly by big estates—which are declared, and which Chart B illustrates—are, for statistical purposes, open to the objection that apart from seasonal variations they are also subject to the influence of their differing time components : e.g., April's crops are harvested in 30 days, as are June's, while the crops in the mid-month of May are garnered in 31 days.

" It is, therefore, essential that any charts which can be regarded as correctly indicative of comparative yields shall illustrate monthly yields in terms of yield per day in each month. A further and useful development of that principle is to express such day-monthly yields in terms of equivalent yield per acre per annum."

Chart D illustrates the production rate of the estates of 100 acres or over as compared with holdings of less than one hundred acres in area. It is well known that of the latter, more than ninety-nine per cent. are small holdings of

which the average area is about two and one half acres each. The graph of the production of the big estates is, as was the case last year, that obtained by plotting the total production of those estates divided by their mature tappable area. It must be pointed out that this method for the year 1930 is not wholly correct as for some months many of larger estates have been reducing the area actually tapped by ceasing to tap their lower-yielding areas. If the crops harvested were divided month by month by the actual area tapped, somewhat higher yields per acre would be indicated. A further factor is that the area tapped by A.B.C. systems has increased during 1930 and the first result of a change over to that system from the normal alternate day system is a falling off in yield. It is hardly practicable to determine exactly how far the two mentioned factors offset each other and as the proportion of the areas concerned, as compared with the total mature area, is small there would be little if any advantage gained by any attempt to adjust the curve of the graph to the varying areas monthly. If the present indications are proved to be a true forecast of events during 1931, any graph for this year will have to be plotted with quarterly adjustments as regards the area tapped, but as has been indicated, the variation during 1930 was not such as to justify the methods.

It will be seen that throughout 1930 the production per acre on small holdings was maintained at a higher rate than that of the larger holdings. On the former, economic necessity has caused the heaviest possible tapping to be adopted. There are many conflicting opinions as to how long this heavy tapping can be continued before it so affects the small holdings bark position as to reduce their output seriously, but a comparison of Chart D for 1930, published in this issue, with that published last year for 1929, though not very conclusive, at least indicates that by the end of 1931 the graphs of production of the big and small estates will approach very closely. In the writer's opinion—formed after close inspections of small holdings all over the country—it is possible and even probable that they will exchange positions within a year or eighteen months from date. It should be understood that this convergence must not be taken as an indication of a permanently marked decline in native production.

Charts C and D are chiefly interesting on account of the clear way in which they show how loyally the large estates as a whole, observed the tapping holiday in May 1930 compared with the non-observance of the tapping holiday by the small holders.

On a few of the Asiatic-owned estates of medium size the monthly returns show that heavier tapping has been started in an attempt to harvest larger crops, but in the great majority of cases, in fact on big estates as a whole, the tapping during 1930 was lighter than in 1929. Statistics as a whole shew that there is hardly a single instance of an estate which has given a trial to the A.B.C. system or to the system of tapping on one-third cuts on alternate days reverting to any heavier system of tapping. There are a few estates which still tap daily on half or quarter cuts, and the system of daily tapping over half the area for alternating periods of three months yet has a few adherents. The results on

some of the best areas tapped by the short task and early tapping system now usual on many, if not most, big estates are very striking. It is hoped later in the year to publish graphs illustrating certain instances of that system when the records now collected have been checked.

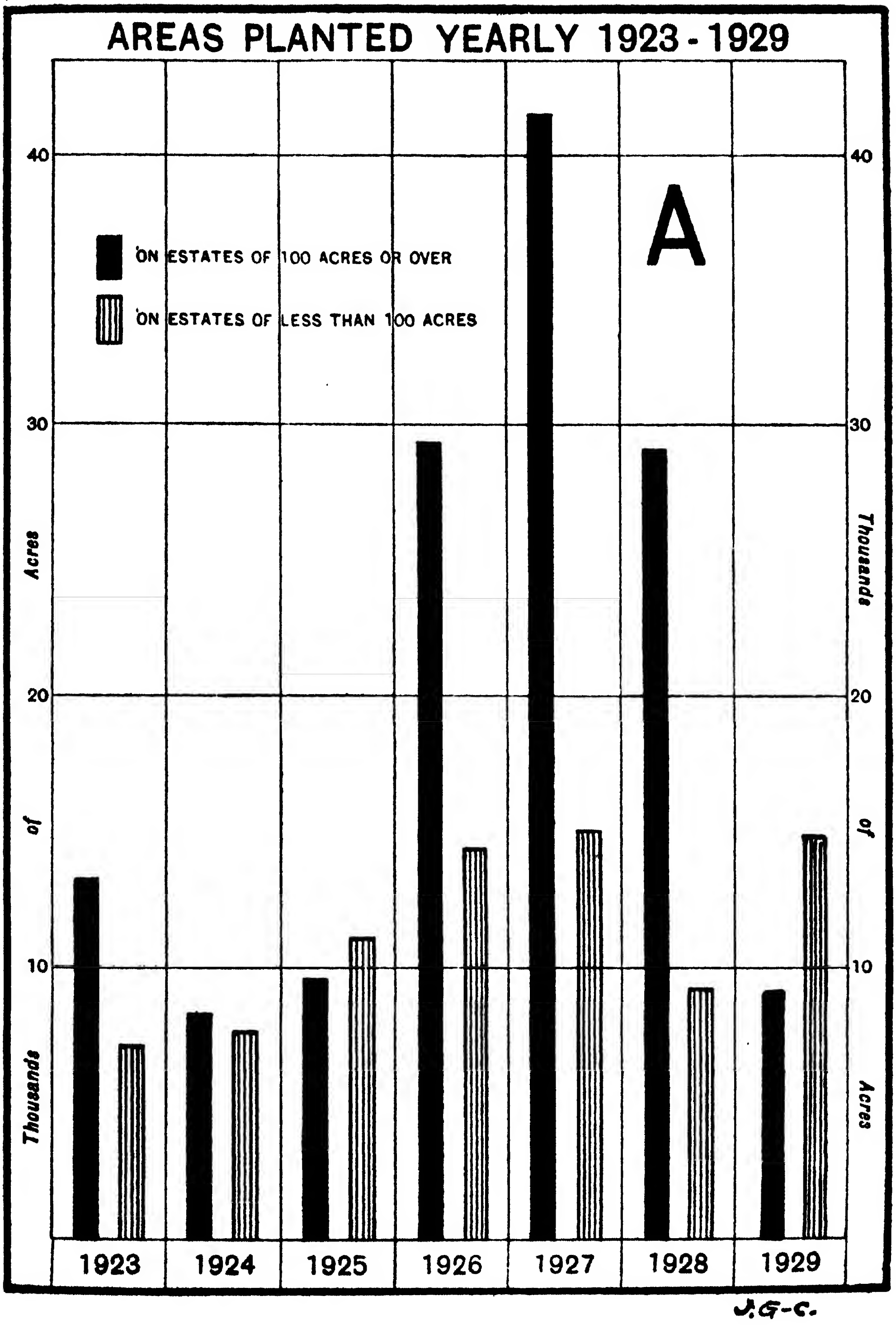
The whole question of the bark position and yields of small holdings is the subject of work now being undertaken by Field Officers of the Department of Agriculture and the Rubber Research Institute of Malaya. A very considerable amount of inspection work has been done which reveals that the average height of the tapping cuts on small holdings is greater than it was a year ago. Various expedients to obtain more latex have been observed. The tapping of superimposed cuts is common and not a few instances have come to notice of tapping by the light of lamps before daylight. Towards the end of the year under review, many small holders ceased to tap, but there were many cases in which tapping was subsequently resumed after it had been stopped for a period. In some of these cases it was proved that after attempts to arrange tapping on the share system had failed, lack of any other means of livelihood compelled the owners and members of their families to tap their own trees. However, although so far there has certainly been no wholesale cessation of tapping small holdings in the F.M.S., the position is otherwise on the island of Singapore. The Singapore holdings, it is well known, were heavily tapped during the restriction years and did not benefit by the enforced light tapping or periodical rest while waiting for a new issue of coupons. They were, in fact, tapped for six years much as the F.M.S. holdings have been for the past two years. Regarding their condition the fact is evident that many have not been tapped for months for the reason that the yield obtained at the last tapping was almost negligible.

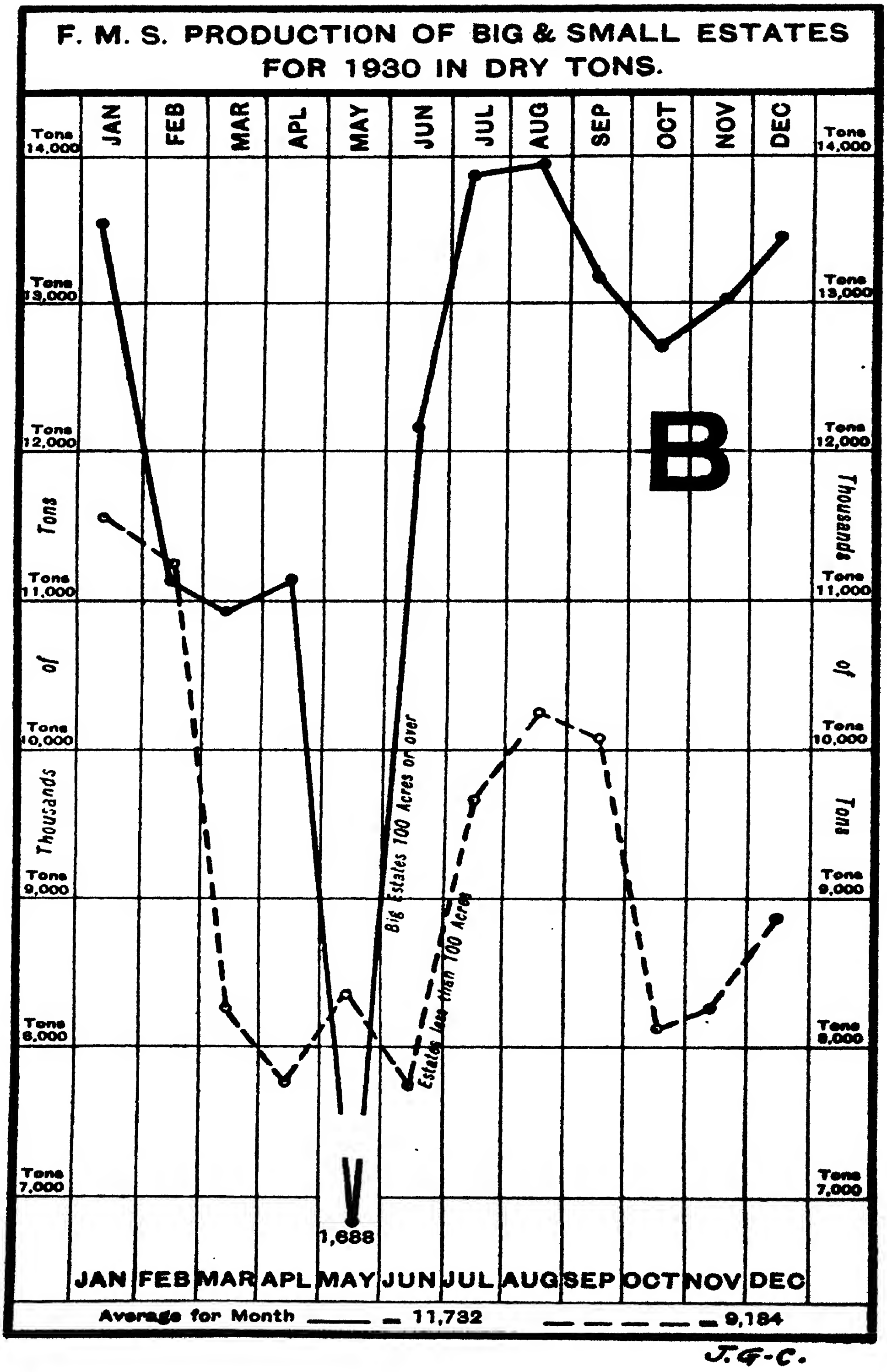
A factor which, unfortunately, the charts published do not illustrate, is that the glut of low grade scrap rubber which flooded the market just after the removal of restriction was followed by a period when such rubber, as collected on the small holdings, became almost valueless. This resulted in more care being taken in its collection and during the greater part of 1930 there was a market for scrap rubber from such holdings. The amount was less in quantity but far better in quality. Examination of rubber in F.M.S. dealers' hands during the past year has proved that the quality of sheet rubber produced on the average small holdings is of greatly improved standard and that the sheet rubber produced on the larger Asiatic owned estates is now equal to that produced on the European owned estates.

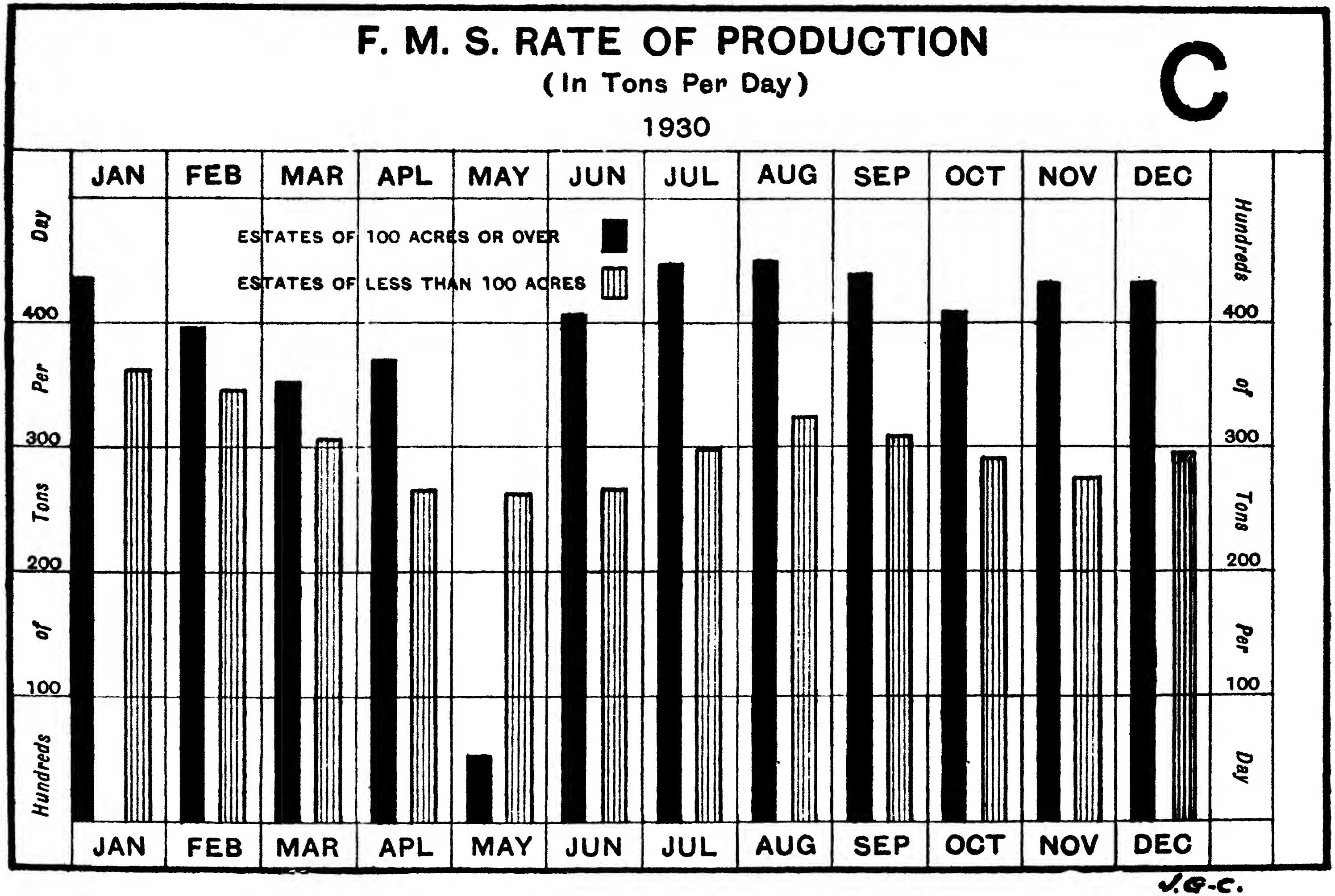
The figures published in this Journal monthly may be suggested as a profitable study for those interested in the monthly proportions of the grades of rubber in dealers' hands; it should, in that connection, be remembered that almost the whole of the F.M.S. dealers' stocks are purchased from the small-holders and the smaller of the Asiatic-owned estates, as very few of the European-owned estates sell their rubber to F.M.S. dealers. The greater part of Straits Settlements dealers' stocks of lower grades of rubber is imported from the Netherlands East Indies.

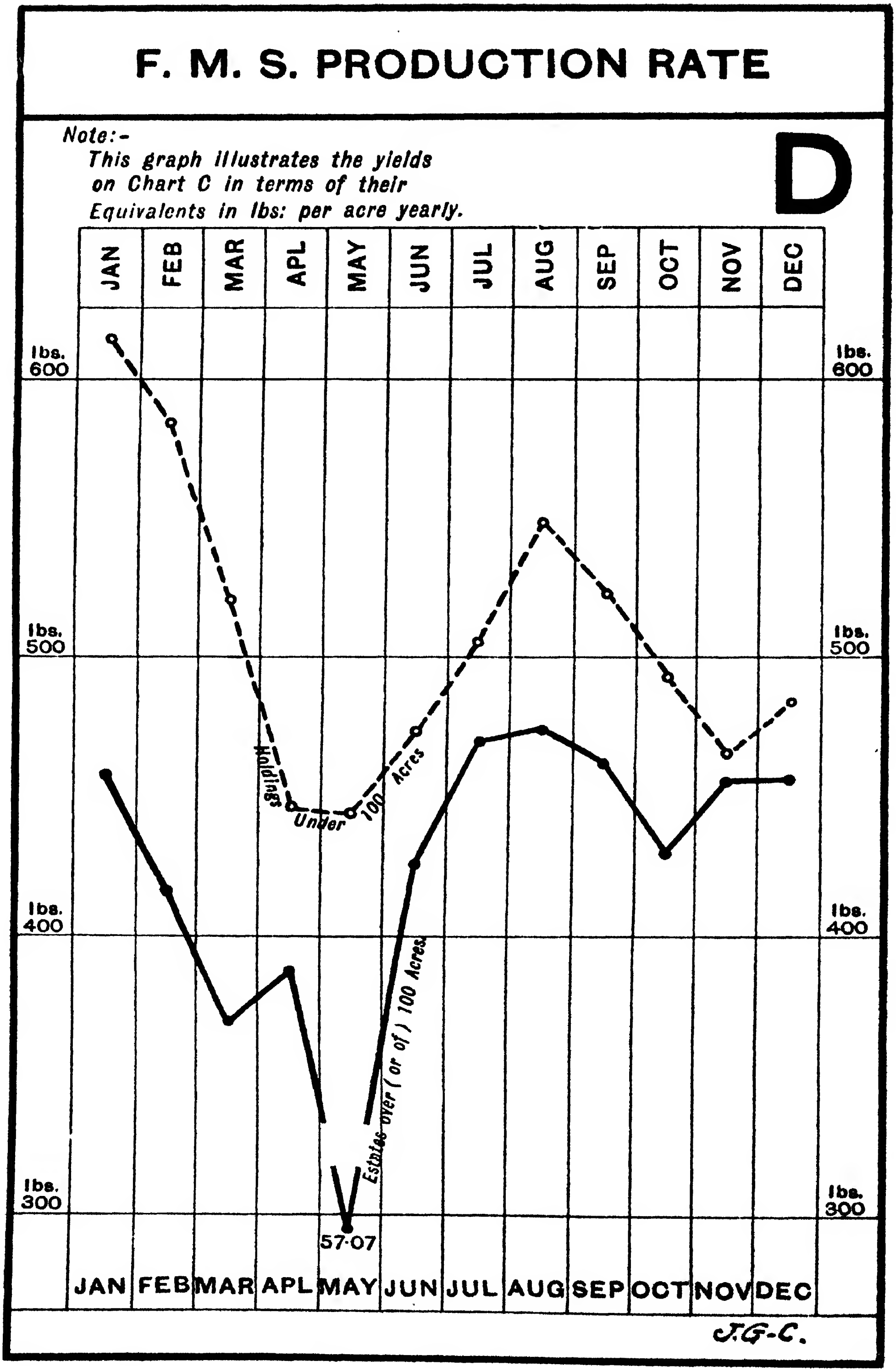
These monthly tables show how close is the relationship between the production of estates and their stocks. There is little or no holding up of rubber on estates in the F.M.S., and in general, it is equally clear that the F.M.S. dealers sell as soon as they purchase. As was indicated by figures published, there have been periods when the Chinese dealers accumulated stocks for the purpose of speculation. During 1930 the range of price—as well as the average price—was the lowest on record in the history of the plantation rubber industry. Also, and the fact is important, during 1930 it has never paid to hold rubber off the market for more than a very short time.

It may, in conclusion, be mentioned that there will, in future, be available for inspection at the Department of Agriculture a series of graphs and charts, kept up to date, illustrating most of the more important official records which refer to the rubber industry.


AREAS PLANTED YEARLY 1923-1929
A
ON ESTATES OF 100 ACRES OR OVER
ON ESTATES OF LESS THAN 100 ACRES
40
30
20
10
Thousands of Acres
1923
1924
1925
1926
1927
1928
1929
J.G-C.


F. M. S. PRODUCTION OF BIG & SMALL ESTATES FOR 1930 IN DRY TONS.
JAN FEB MAR APL MAY JUN JUL AUG SEP OCT NOV DEC
Tons 14,000
Tons 13,000
Tons 12,000
Tons 11,000
Tons 10,000
Tons 9,000
Tons 8,000
Tons 7,000
Thousands of Tons
B
Big Estates 100 Acres or over
Estates less than 100 Acres
1,688
Average for Month 11,732
9,184
J.G-C.


F. M. S. RATE OF PRODUCTION
(In Tons Per Day)
1930
C
JAN FEB MAR APL MAY JUN JUL AUG SEP OCT NOV DEC
ESTATES OF 100 ACRES OR OVER
ESTATES OF LESS THAN 100 ACRES
Hundreds of Tons Per Day
100
200
300
400
J.G-C.


F. M. S. PRODUCTION RATE
Note:-
This graph illustrates the yields
on Chart C in terms of their
Equivalents in lbs: per acre yearly.
D
JAN FEB MAR APL MAY JUN JUL AUG SEP OCT NOV DEC
lbs. 600
lbs. 500
lbs. 400
lbs. 300
Holdings Under 100 Acres
Estates over (or of) 100 Acres
57·07
JAN FEB MAR APL MAY JUN JUL AUG SEP OCT NOV DEC
J.G-C.

MECHANICAL CULTIVATION OF RICE

BY

J. LAMBOURNE,

Assistant Agriculturist.

Introduction.

The information contained in the following article has been compiled with a view to bringing together as much information as possible on the cultivation of rice by means of modern tractors and other machinery.

Tractors and machinery have been used with success in the cultivation of rice in parts of the United States of America, Brazil and Southern Europe, notably Italy, for some years. Modern machinery has also been used in recent years for the cultivation of this crop in New South Wales, Australia. Although the cultivation of rice lands with tractors, ploughs and disc harrows was practised in Siam as long ago as 1912 [1] and experiments in the use of tractors and ploughs were carried out in Cochin China [2] and Malaya [3] in 1917 and 1922 respectively, it is only during the last 5 or 6 years that large scale rice farming with modern machinery has been practised in the eastern tropics. It is stated that both in Siam and Indo-China, power equipment has been used extensively with satisfactory results, both as regards costs and amount of work done.

In Travancore, India, [4] a Fordson Tractor has been used with success for ploughing in an experimental padi farm for some years and it is said to be more efficient and less costly than bullocks or buffaloes. There appears to be no record of large scale padi farming with modern machinery in India, although tractors and machinery have been in use for the cultivation of other crops.

Selection of Land.

Land for the purpose of rice cultivation on a large scale should be level or have but a gentle slope, so that bunds for retaining the water are far enough apart to allow of fairly large bays. The soil best suited to rice cultivation is a clay loam with an impervious clay sub-soil fairly near the surface. Loamy and even sandy soils are said to produce good crops of rice under ideal conditions of irrigation and drainage but it is necessary that there should be an impervious sub-soil near the surface, otherwise considerable loss of water may occur. At the same time, the land should be capable of being easily and efficiently drained, otherwise considerable delay may occur at harvest time, with a probable loss of crop.

Preparation of Land for Irrigation.

The most suitable land for padi cultivation in Malaya, apart from that already used for that purpose or planted with other crops, will most probably be covered with jungle. Before machinery can be used on this land it will be

necessary to clear it of all timber and stumps, which may prove somewhat expensive. Once the land has been cleared, levels will have to be taken to ascertain the position of the bunds. The bunds should be made according to the contour of the land and high enough to retain water to a depth of at least 6 inches. In the United States of America,[5] where machinery is used, bunds of a permanent nature are built not less than 10 feet wide at the base with sloping sides so that they are not damaged by machinery passing over them. If bunds are built in this way it is said that the whole field can be cultivated as one unit, rice being grown on the bunds as well as on the rest of the field. Wooden gates are provided at intervals in the bunds to allow the water to flow from one field to another. These gates are usually of the box type fitted with narrow horizontal boards so that the depth of the water on the bays may be regulated.

Method of Making Bunds.

In the United States of America[5] bunds are usually made in the following manner :—A survey of the land having been made and the position of the bunds pegged out, the survey pegs are connected by ploughing a furrow to mark the base of the bund. All corners are rounded off so that machinery can be used close to the bunds. The land on this contour is then ploughed with a tractor drawing a 10—12 furrow plough back furrowing to the first furrow. The main bunds are often built with a " Fresno Scraper," the interior bunds being made with what is known as a "Checker" drawn by one or two tractors, depending on the size of the checker and the horse-power of the tractors used. On large areas these outfits are said to be able to build 10 to 15 miles of bund per day.

The checker is generally home-made and consists of planks 3 inches thick, 12 inches wide and 16 to 24 feet long. Two or three of these are fitted together to form one wide plank which is lined with steel. Two of these wide planks are braced together on edge 10—18 feet apart at one end tapering to 3 to 6 feet apart at the other forming two sides of a box. The upper edges are set slightly farther apart than the lower edges so that the planks slope outwards. This implement is drawn wide end forward and the loose surface soil is drawn through the narrow end making bunds 12 to 24 inches high and 4 to 6 feet wide at the base.

In Siam[6] and Indo-China, a Martin Ditcher has been used for making bunds.

Where large areas of land are being opened, mechanical drain diggers might be used for making irrigation canals and Scrapers or Road Graders drawn by tractors could be used for levelling the land.

Preparation of the Seed Bed.

The object to be attained in preparing land for padi is a fine tilth; the land is therefore ploughed to a depth of 4 to 5 inches either with mould board or with disc ploughs. It has been found both in Siam[6] and Indo-China that a disc

plough provided with 10—13 discs fitted vertically on a spindle, the discs being set at an angle of 45° to the line of draft is best suited for ploughing newly opened land. Examples of such ploughs are the Wheatland plough made by J. I. Case & Co., Wisconsin and the McCormick Deering harrow-plough. These ploughs cut to a width of 8 to 9 feet, and when drawn by a tractor, are capable of ploughing over 20 acres per day. For land that has been under cultivation, in order to turn in the stubble and weeds, the mould-board type of plough is preferable.

After the land has been ploughed, it is harrowed with tandem disc harrows, several types of which are on the market—followed sometimes with spike harrows. Wooden drags made with heavy planks bolted together are dragged over the land to break the clods of earth and level the surface. A soil pulveriser or "ring roller" may be used with advantage on some land to obtain a smooth and firm seed-bed. The amount of working required to obtain a fine tilth will depend on the nature of the soil.

Sowing the Seeds.

The seed can be either drilled or broadcasted. Drills, Endgate broadcast seeders or combined fertilizer and seed drills can be used for this purpose. On well prepared land the drill is said to distribute the seed more evenly and at a more uniform depth; consequently a more even stand of plants is obtained than is possible with a broadcast seeder and usually less seed is required. On the other hand, with a comparatively rough or wet seed-bed and when time is a consideration, the broadcaster does the work more rapidly.

Irrigation.

Water for irrigation can be obtained by gravity from higher levels, but it is often obtained from rivers, streams or deep wells, from which it has to be lifted by powerful pumps. It is distributed over the area to be irrigated by means of canals and smaller distributaries. In the Gulf coastal plains of the United States of America[7] the pumping plants, canals and sometimes the land are under the control of private companies, who furnish water on a rental basis, either taking part of the crop or a fixed rate in cash for the use of the water.

Pumps.

Pumps used for irrigating padi land vary with the conditions under which the water has to be obtained. For lifts up to fifty feet centrifugal pumps are often used. If the quantity to be raised is great and the lift low the Humphrey Automatic pump is said to be the most efficient. It acts by recurrent gaseous explosions which keeps a current of water moving. There is no piston, the only working parts being automatic valves that admit water and control the supply of explosive mixture, and the exhaust. Where there is a head of water, hydraulic rams are convenient and economical.

On a 600 acre farm in Siam,[6] a Kimball 12 inch turbine pump with a 6 feet lift and a discharge of 3,000 gallons per minute is being used. This pump, which costs approximately $2,000, is driven by a belt from a 12/20 H.P. Tractor supplying water at a cost of about $3.50 per acre per annum.

The size and capacity of the pumping outfit required will depend on the acreage to be irrigated, the height to which the water has to be lifted and the nature of the soil. The capacity of the pump should not be less than 6.3 gallons i.e. one cubic foot per minute per acre. Less compact soils require more water as allowance has to be made for seepage. About 4½ acre feet of water is said to be sufficient for a crop of rice. In Krian, it is said that one cusec (373.6 gallons per minute) is sufficient to irrigate fifty acres.

Irrigation of the Crop.

The first irrigation usually takes place after sowing the seed, but where the land is very hard and dry it is sometimes necessary to irrigate in order to make cultivation easier and to obtain a fine seed bed. In the United States of America only sufficient water to germinate the seeds is allowed on the land and after 2 days this water is drained off. A second irrigation is given before the soil becomes dry and caked, but this water is drained off quickly. Irrigation takes place once every seven or ten days until thirty days after the seedlings appear above ground, when the land is gradually submerged to a depth of about 6 inches. This depth of water is maintained on the land for 90 to 140 days depending on the variety of padi under cultivation. Where rain falls at the right time it may not be necessary to irrigate until the padi plants are 10—12 inches high.

Drainage.

Good drainage is important, since as the crop approaches maturity, the level of the water must be lowered. Previous to the final draining, no water should be allowed to enter the land for about 10 days, during which time the water level is gradually lowered. Draining usually takes place when the panicles are well turned down and the lower grains are in the soft dough stage; at this time the upper two-thirds of the grains on the panicles are turning yellow.

Harvesting.

Harvesting usually takes place from 10 to 18 days after the removal of the water, but care should be taken that the crop is neither under nor over ripe. In the United States of America,[7] the best time to harvest is said to be when the heads are well turned down and the grains in the lower part of the panicle are in the hard dough stage. If the crop is harvested too early a large number of light grains will result, while if the crop is over-ripe shattering will take place and grain will be lost.

Twine binders or combined Harvester-Threshers are used for harvesting the crop. The latter machine does the three operations of harvesting, threshing and winnowing, but difficulty is experienced with this machine where uneven ripening of the crop takes place. The twine binders used for reaping padi are usually fitted with auxiliary engines which drive the knives and other working parts, owing to the fact that the "bull wheel" which does the work on dry land, may not be able to get a grip where the soil is wet and muddy, as it is liable to be on irrigated land. The above machines can be drawn by motor tractors and are said to be capable of binding 35—40 acres per day.

When reaper binders are used the sheaves are shocked in the field in a similar manner to wheat and oats, in temperate countries, but in Malaya this may not be possible owing to weather conditions. In the United States of America these shocks are capped to protect them from sun and rain which may cause the splitting of the grains. Capping is done by slipping the band of a sheaf up to near the heads of grain and then placing it head downwards on the top of the shock turning the straw down evenly all round to form an umbrella-shape shelter.

Threshing.

Threshing should not take place until the grains have had time to harden and it is essential that the heads should be prefectly dry. Threshing should not, therefore, take place in the early morning before the dew has evaporated. Threshing machines, similar to those used for wheat, are used for threshing rice, but the teeth of the cylinder should be set rather wider apart, otherwise the grains are liable to be cracked. Special rice threshing machines are now made.

Yields.

In countries where rice is cultivated on a large scale with modern machinery and where attention is given to manuring, the average yields per acre are greater than in most eastern countries where primitive methods of cultivation still prevail. Average yields of from 1,800 to 5,900 lbs. (320 to over 1,000 gantangs) per acre are obtained in the United States of America, Italy and Spain, while yields of 2,530 lbs. (450 gantangs) are recorded from areas cultivated with modern machinery in Australia and Siam. The average for the whole of Malaya is in the neighbourhood of 200 gantangs (1,125 lbs.) per acre although much higher yields are obtained under controlled irrigation in favoured areas. It is not claimed that, given the same conditions, larger crops can be obtained by the use of modern machinery, but that larger areas can be handled at a cheaper cost and that profitable crops can be obtained by this method of cultivation.

Tractors.

There are a large number of types of tractors on the market and at recent tractor trials held under the auspices of the Royal Agricultural Society of England in conjunction with the Institute of Agricultural Engineering, Oxford University, thirty-three tractors were entered. These tractors were of three main types as follows :—

1. Paraffin driven tractors all of the wheeled type.
2. Petrol driven tractors of both wheeled and track laying types.
3. Fuel Oil tractors with both Diesel and semi-Diesel engines all of the wheeled type.

The average amount of fuel and lubricating oil used by the different types of tractors taking part in the above-mentioned trials together with costs based on present market prices of fuels and lubricating oil in Malaya are given in the following table.*

Type of tractors.	Average consumption of fuel per 100 horse-power hours.		Cost of fuel 100 horse-power hours.		Cost of fuel per acre for ploughing @ 5½ acres per 100 h.p. hours	Average lubricating oil consumption per 100 h.p. hours.	Cost of lubricating oil per acre.
	Drawbar	Belt.	Drawbar	Belt.			
	Gall.	Gall.	$	$	$	Gall.	$
Paraffin (Kerosene) Tractor.	14.37	10.16	8.23	5.81	1.48	0.36	.14
Petrol Tractor.	12.90	10.57	10.83	8.88	1.79	0.20	.08
Diesel Tractor.	9.19	6.12	1.71	1.14	.31	0.57	.22
Semi Diesel Tractor.	11.50	7.98	2.41	1.67	.44	0.45	.18

*These trials were conducted on ordinary arable land, not on padi land.

The above costs are based on the following prices:—

Kerosene in 4 gallon tins @ $2.29 per tin.
Petrol in 4 and 65 gallon Drums @ 84 cents per gallon.
Diesel Oil in 65 gallon Drums @ $12.50 per drum.
Solar Oil in 65 gallon Drums @ $13.60 per drum.
Lubricating Oil in 42 gallon Drums @ $2.15 per gallon.

It is stated that an estimate based on the performance of thirteen tractors indicate that 100 horse-power hours work on drawbar were required to plough 5½ acres of land on which the ploughing tests were conducted at a depth of 4½ inches.

Trials with different types of tractors have also been carried out in Siam and the results of these trials kindly supplied by the Bureau of Agricultural Science, Bangkok, are reproduced in the following table. The amount of work done and costs of fuel used have been converted to acres per hour and costs per acre in Straits currency respectively:—

Type of Tractors and Horse-Power	Implement used.	Soil.	Depth ploughed inches.	Acres per hour.	Fuel costs per acre.
Lanz 22/28 Crude Oil "Bulldog"	3-disc plough.	Very heavy clay, dry	4	0.60	0.90
do.	5-share plough	Medium clay dry	4	1.14	0.60
do.	"	do.	4	1.48	0.52
do.	"	Medium silty clay.	4	0.96	0.80
McCormick Deering 20 H.P.	12- Disc plough	Spongy clay.	4	1.20	1.00
McCormick Deering 10/20 H.P.	"	Light silty clay	4½	2.00	0.52
McCormick Deering 15/30 H.P.	Mould Board 4—14"	Clay virgin soil under grass.	5	1.60	1.00
Fordson 24 H.P.	18" 2-share plough 24 Disc harrow 18" Discs.	Raised land clay, not so compact as a padi field.	6-7	0.25	1.28*

The above costs are for fuel and lubricating oil only. In order to arrive at the total cost of tractor work it is necessary to include allowances for interest

* Cost of three operations, ploughing harrowing and cross-harrowing.

on capital, depreciation, repairs and labour. The cost of these items is not given in the reports in question.

The writer is informed that two farms in Siam, one of which is 700 acres, are operated with tractors and modern machinery. On one farm a 10/20 H.P. McCormick Deering tractor operating a 6 feet harrow-plough, completed 20 acres per day of 10 hours at a fuel cost of 60 cents per acre. The proprietors of the other farm are using a 15/30 H.P. tractor of the same mark and operating with a 4-bottom 14 inch plough averaged 16 acres per day at a fuel cost of 99 cents per acre.

In is stated that tractors and tractor equipment for the cultivation of irrigated rice land has proved successful in the tropics, being used extensively in Indo-China and Siam. A Demonstration Station of 100 hectares (=247 acres) in Indo-China is being cultivated with the McCormick Deering machinery. The implements used are as follows :—

One 15/30 H.P. tractor said to be capable of working 200 hectares (494 acres).

One 10 ft. Tandem disc-harrow.

One 9 ft. Harrow-plough.

One 10 ft. Tractor power-lift seed drill.

A Martin Ditcher was used for making the bunds but a certain part of this work was done by hand.

The 100 hectares was harrow-ploughed in 9 days and disc-harrowed in 10 days, which equals 27.47 and 24.7 acres per day for ploughing and harrowing respectively. The extra day taken to disc-harrow the land was attributed to slipping of the tractor wheels on the soft soil. A few days after the first cultivation, one half of the area was again disc-harrowed and the other half re-ploughed with the harrow-plough, which made a perfect seed bed on part of which seeds were drilled and on the other part broadcasted by hand for comparison. The results of this experiment, together with costs are not yet known.

The machinery required to work an area of 500 acres is stated to be: One 15/30 H.P. tractor, one 9 feet harrow-plough, one 10 feet tandom disc-harrow, one drag harrow, one 10 feet double gang soil pulveriser, one 10 feet power lift seed drill, one 8 feet rice binder and one 23 x 28 inch rice thresher. The cost of this machinery including packing, but not freight to destination, is approximately $6,325/- (Straits Currency). If a broad-cast seeder instead of a seed drill is obtained the above amount can be reduced by $263/-

In Malaya, tractors have been used with varying success during the last decade for drawing cultivating machinery on rubber and coconut estates . The success or otherwise of the tractors depended to a large extent on the implements used and the type of land cultivated. When used with the disc-harrow, tractors were almost invariably satisfactory, but with a mould board plough they were only successful when the land was comparatively free from buried stumps and timber. The amount of work done with ploughs varied between three and five acres per day and disc harrowing between fourteen and twenty acres per

day. Costs varied between $4.50 and $6/- per acre for ploughing and 75 cents to $2.30 for disc harrowing.

At the Government Experimental Plantation, Serdang, where Cletrac tractors with Oliver one and two furrow ploughs and a disc harrow were employed in cultivating newly opened land, the costs per working hour taken from data collected over three years are as follows:—

Driver's wages	$0.17
Coolies wages	0.05
Kerosene (1 Gall. per hour)	0.75
Petrol .101 Gall. per hour @ $1/-	0.10
B. B. oil 0.067 Gall. per hour @ $3/-	0.20
Gear oil .018 Gall. per hour @ $2.15	0.04
Spare parts and repairs	0.42
	$1.73 per hour.

The above figures are calculated on the hours the tractor worked, no account being taken of time lost for repairs or owing to wet weather. The cost of ploughing newly opened clean cleared land varied between $6/- and $15 per acre depending on the condition of the land. The tractor was often stopped by obstacles in the ground and the negotiation of soft spots where it sunk and had to be extricated thereby wasting time and adding to the cost.

The cost of ploughing land that had already been cultivated averaged $5.50 per acre, while disc-harrowing cost from 71 cents to $1.86 per acre.

A Fordson tractor was used in Malacca in 1922 for opening up "lallang" grass land for the cultivation of padi. Although quite successful it was found to be more expensive than bullocks due to the land not having been tilled previously, the drivers being unused to the work, and the small size of the land divisions. The land was ploughed at the rate of 2.9 acres per day of 8 hours at a calculated cost of $11.50 per acre. Harrowing and cross-harrowing cost, for the two operations, $2.30 per acre. A Cletrac tractor was afterwards used and the costs were much the same as when the Fordson was employed. Both tractors sunk into the ground on soft land.

The cultivation of rice land by means of a tractor and implements has been carried out recently at Pulau Gadong Padi Station in Malacca by Mr. Newman, Agricultural Field Officer, Malacca. The implements used were a Fordson Tractor, an Oliver 2 share plough and a John Deer two-gang 14 disc harrow.

The cultivation was of dry land, ploughing to a depth of about 4 inches and afterwards disc harrowed to produce a fine tilth.

The work was quite satisfactory, but as the area was only just over 3½ acres divided into plots of 1¾, ¼ and approximately 1 acre, each, cultivated separately, the amount of work performed per hour was less than on large areas. The area

ploughed per hour was 5/6 acre and disc-harrowing at the rate of $2\frac{1}{4}$ to $2\frac{1}{2}$ acres per hour at a cost of approximately $1.20 and 5 cents per acre respectively for fuel, lubricating oil and driver's wages.

Cost of Production.

Without experience it is difficult to estimate the cost of production as there are so many factors to be considered, not the least being the capital cost of the machines. This will depend largely on the condition of the land to be opened and the difficulties to be overcome with regard to irrigation and drainage. Newman working in Malacca has estimated that the costs of production on a large scale farm of 800 acres including management, depreciation on implements, machinery and buildings capitalised at $140,000 to be $21.45 per acre. Tempany, Jack and Sands have estimated the costs of production, including management, in the neighbourhood of $20 per acre. Taking the higher figure and a crop of 300 gantangs of padi per acre at 13 cents per gantang, a profit of $17.50 per acre is obtained.

Summary and Conclusions.

The cultivation of rice by mechanical means has been carried out with success in different parts of the world, notably in the United States of America, parts of Southern Europe and to a small extent recently in Australia, Indo-China and Siam.

2. Tractors and modern machinery have not been used extensively in the cultivation of rice in the Eastern Tropics due to the fact that this crop is grown mainly by small-holders who cannot afford machinery.

3. Harvesting and threshing machines, similar to those used in temperate climates for other cereals, can be used for rice and special machines adapted to this crop are now made.

4. Where machinery is used in the cultivation of rice it is essential to have controlled irrigation and efficient drainage.

5. Water for irrigation is obtained either from higher levels by gravity or it is raised from rivers, streams or deep wells by means of powerful pumps.

6. The size and capacity of the pumping outfit will depend on the acreage to be irrigated, the height to which the water has to be lifted and the nature of the soil. The minimum capacity of the pump should not be less than one cubic foot per minute per acre.

7. Modern tractors are capable of operating all machinery on the farm, including pumps.

8. Without experience it is impossible to estimate accurately the cost of production as this will vary with the condition of the land to be opened. Given favourable conditions, however, it has been estimated that the cost will be between $20 and $25 per acre.

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THE RURAL LECTURE CARAVAN

BY

J. Corrie,

Personal Assistant to the Director of Co-operation

AND

F. G. Spring,

Agriculturist (Rubber), seconded to the Co-operative Societies Department.

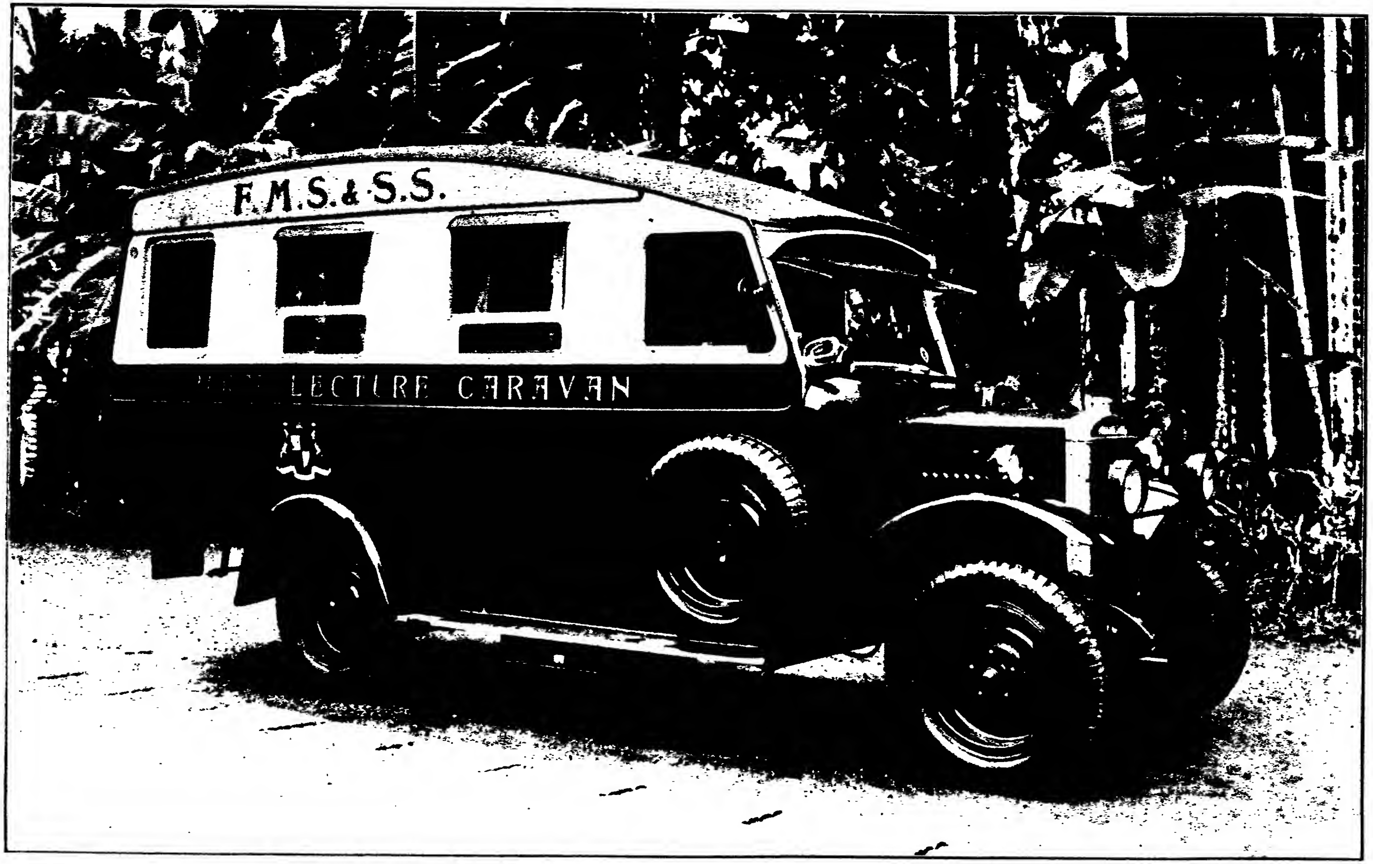
The project of putting on the road a travelling cinema and propaganda caravan to be run jointly by the Co-operative Department, the Department of Agriculture and the Rubber Research Institute of Malaya was described in an article appearing in the number of this journal published in February, 1930. In that month, financial provision was made by Government and by the Board of the Rubber Research Institute for this purpose. The sum voted was divided into two parts —a portion being allotted for capital expenditure and the balance for annually recurrent expenditure on film propaganda and running costs. A joint Committee consisting of the Directors of Agriculture and Co-operation and the Director of the Rubber Research Institute was formed to supervise and co-relate activities in connection with the venture.

There was no precendent in Malaya for the building of a caravan of the type required and little or no data to work on. Much preliminary investigation had to be undertaken. The Committee obtained the best advice available locally and in Madras on the subject of the construction of the van and of a trailer. The services of the Acting Instructor of the Government Trade School at Sentul were availed of to prepare specifications and generally to supervise construction on behalf of the joint Departments.

After consultation, it was decided that the body work of the caravan could be constructed by the Carriage Department of the F.M.S. Railways, and the necessary authority was obtained. Construction was started on 8th. August, 1930, and so rapidly did it progress that the caravan was given its first field test on 19th. November, 1930. Subsequently, as described below, it has been extensively employed.

In drawing up specifications for a vehicle of this description it had to be borne in mind that a very large and varied amount of material, varying from a teaspoon to a cinema projector had to be carried; that disposable space was very limited and the comfort of the driver and lecturers had to be studied. It was necessary firstly to consider the materials to be carried and secondly, to make provision for every article in a properly designed compartment.

The body framework is of seasoned Chengai wood, built on a Morris 30 cwts. lorry chassis. The roof is of domed design. The exterior panelling is of aluminium sheeting, spray painted royal blue below and ivory above, with a



The Rural Lecture Van Organised by The Department of Agriculture, Co-operative Department and Rubber Research Institute of Malaya.

A Lecture and Demonstration Given in a Village School During a Tour of The Rural Lecture Van.

"duco" finish. On each side appears the F.M.S. Coat of Arms. There are two ventilators in the roof and a chimney above the cooking stove. It is interesting to record that the ventilators, which were made by Chinese craftsmen, are miniature replicas of similar ventilators on F.M.S. Railway carriages.

Behind the driver's cab the body is divided into two compartments. A small sliding shutter is provided in the bulkhead between the cab and the inner compartment so that the lecturers can speak to the driver when necessary.

This front compartment is intended for living quarters for two Malay lecturers. Upholstered sleeping berths are provided on each side. By day these berths form seats when the caravan is travelling from place to place. Drawers, some in tiers, are provided under the berths for the accommodation of officers' clothing. The windows are of "triplex" glass raised or lowered by revolving handles. Detachable mosquito frames for the windows are carried. A folding, oval wash-hand basin is fitted centrally on the bulkhead next the driver's cab, with a drain through the floor. The basin is fitted with a tap and tank on the partition with a capacity of about 4 gallons. On the tank a mirror and clock are provided and there are several conveniences in the way of shelves, brackets and coat-hangers.

The rear compartment has, on the right-hand side, two large cupboards. That nearest the inner partition is zinc-lined and serves as an ice chest. The other cupboard, nearest the rear, contains cooking utensils, kettle, and jars and containers for such necessities as rice, tea, sugar and coffee. Above is a zinc covered table top to which is clamped a "blue flame" oil stove of the "Dangler" type.

The left hand side is fitted with a large cupboard divided into suitable compartments of correct size to accommodate cinema projector, dynamo and other articles. Above the cupboard are several drawers, one with partitions for carrying canisters of Cine-Kodak films, another for spare projector bulbs, electric torches, battery cells, and another for crockery. To the right is a recess in which a small, folding table is carried, and a pigeon hole, the outside portion of which forms a zinc drip tray with outflow plug under the cock of the water tank. Above the drawers again is a shelf with a coaming for odd articles. To the right of the drawers is a drinking water tank fitted with a nickel plated tap.

The entrance to the body is by a door centrally situated at the rear, the lower half panelled and the upper half fitted with a fixed "triplex" glass window.

The interior of the lorry: drawers, cabinets, lockers and cupboards are of walnut, fine finished and polished. All hinges, locks, bolts, clips, coat hooks, clamps and other metal fittings are of strong, solid manufacture, brass and nickel-plated. As far as practicable, the kitchen fittings are white enamelled.

Two petrol-pressure mantle storm lanterns are carried. These have not been altogether satisfactory and it is proposed to replace them by an electric light installation, providing at the same time a small fan in the inner compartment.

The power unit for the Cine-Kodak projector is interesting. It consists of a Bell and Howell's 1000 watt. generator driven by a leather belt running round

the "jacked" up, off, rear wheel. A suitable bracket for the dynamo is clamped on the ofiside footboard near the wheel. When the generator is in use, a portable switch-board fitted with pilot lamp, ammeter and voltmeter, main switch and plug and a length of flexible wire, connecting plug to projector, is placed on the footboard. A steady voltage of 120 is easily obtained. The total mileage covered to date amounts to 2015. The estimated mileage per hour of film is 15. The petrol consumption is between 14 to 15 miles per gallon.

The chauffeur of the caravan, who is also responsible for the power unit, is a Malay selected from the Government Trade School, with three years' training as a fitter and electrician.

On the front of the caravan, above the driver's cab, is painted in Arabic characters the inscription "Suloh Kemajuan Kehidupan Kampong" which might be rendered "the torch of rural prosperity". The same inscription also appears in the centre of the rear of the caravan. Outwardly, the caravan presents a distinctive, "stream line" appearance and is a credit to the supervisors and craftsmen of the Railway Workshops. The trailer has not yet been built.

The main purpose of the caravan is to give demonstrations to Malays and Indians on agricultural and co-operative subjects, by means of lectures, displays of exhibits, lantern slides and cinematograph films.

The caravan is under the joint control of the Department of Agriculture, the Rubber Research Institute of Malaya and the Co-operative Societies Department. It carries a staff of two or three Asiatic officers of the above mentioned departments who are responsible for carrying out the programme of each tour. A European officer of the Co-operative Societies Department has hitherto accompanied the caravan during the initial tours. In future, however, it is intended that the caravan shall be subject to the general supervision of the Agricultural Field Officer in charge of the area covered by the tour.

The first occasion that the caravan was operated was at Dusun Tua in Selangor on the 19th. November, 1930. This was followed by a brief tour in the Klang and Kuala Selangor Districts of Selangor at which an incomplete programme was followed.

Subsequently, two complete tours of about a fortnight each have been undertaken, the first in the Ulu Langat District of Selangor in January and the second in the western portion of the Negri Sembilan during March, 1931.

The site selected for a demonstration has usually been the compound of a large Malay school. While the exhibits were displayed in the school, the remainder of the programme was carried out in the open when weather conditions permitted.

A typical day's programme was somewhat as follows:—The journey from one centre to the next was made in the course of the morning. On arrival at the new centre, the necessary preparations were made for the afternoon and evening demonstrations. About 4.30 p.m. a lecture on the subject of padi cultivation and its pests was delivered with the aid of exhibits. Such lectures and demonstrations proved most interesting and the specimens were closely inspected by the Malay

audience, many of whom brought books in which they made notes on the exhibits, more especially on the specimens of pedigree padi. In the Negri Sembilan a number of orders were subsequently received for supplies of pure strain padi for planting.

Twelve such lectures on the cultivation of rice were delivered by the Malay officer of the Department of Agriculture on duty with the van. The total number of persons attending was 2,200, including local headmen, chiefs and other prominent members of the local communities.

After an interval for the evening meal at about 7 p.m. a lecture on Mouldy Rot Disease of rubber and its treatment was delivered illustrated by lantern slides and a wall diagram. This lecture was delivered on fourteen occasions to a total attendance of 8,600 Malays.

Following the above lecture, the Malay film prepared by the Co-operative Societies Department entitled "Thrift Versus Extravagance" was screened. The pictures were closely followed by the audience and it is evident that they were understood and appreciated. This film has now been shewn to audiences amounting to 13,800 Malays.

The caravan has also visited a number of rubber estates where the Indian co-operative film "Muniandi and Kuppan" has been shewn seventeen times to a total of 6,600 Indian labourers.

In the light of experience gained, a full programme of tours in other parts of the Federated Malay States and Straits Settlements is being arranged for the remainder of the year.

It is premature at present to estimate the educational value of these tours, but it is evident that the demonstrations have attracted large audiences and aroused considerable interest among the rural population for whose benefit they are designed.

The three departments responsible for these tours wish to acknowledge the material assistance received from the Education Department and the F.M.S. Police.

LIFE CYCLE OF A FLY PEST (ANTHOMYIID),* ON *NIPAH FRUTICANS*

BY

J. W. SEWILL, M.A. (Cantab.) A.I.C.

Owing to the difficulty in obtaining a supply of fresh male nipah flowers near Kuala Lumpur, Mr. G. H. Corbett, Government Entomologist, S.S. and F.M.S., suggested that the writer should endeavour to ascertain the life cycle of this insect.

Method. Since practically every spathe is infested with eggs and maggots in all stages of development, care had to be taken not to confuse generations. In each case the eggs were collected immediately after being deposited by a female actually under observation. They were placed in a plugged tube and on hatching, supplied every day with fresh food. Each male inflorescence so used was cleaned of all other eggs and maggots. The maggots were continually transferred to fresh flowers until they were full-grown, when they were removed from the tube and placed in a cage on dry earth to pupate.

Eggs. These are cream coloured, torpedo shaped bodies, with fairly resistant skins, about 2 mm. long. They were laid in groups of twenty or more, resembling cartridges in a belt, under the sheath of the unopened male inflorescences. As the flies failed to breed in captivity, the method of depositing the eggs was somewhat of a puzzle since the sheath fits very closely round a pair of male flowers. Careful observation of a group of flies on a palm in the field showed that the females stand at right angles to, and with their backs toward the edge of the sheath. By means of a long telescopic tube-like ovipositor they force the eggs, which could actually be seen passing down the ovipositor, under the edge of the sheath. The ovipositor appeared at first sight to be the extroverted cloaca but by chance a female was observed with the tube extended which had been seized by a dozen small ants. This fly was killed and the abdomen opened under a microscope. The cavity was crammed with eggs.

EGGS. (x3).

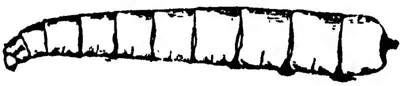
The ovipositor was now seen to be truly telescopic in three segments. The distal segment is certainly chitinous and provided with a few stout hairs, which no doubt assist in the penetration of the flower sheath. The middle section is a mass of retractile longitudinal muscle bundles. The integument, which is quite transparent, is closely studded with short thornlike hairs. Near the base are two long stiff dark hairs and two yellowish transparent bodies resembling tubes. The proximal segment is provided with muscle bundles ending in the

This insect has recently been described by Malloch as *Phaonia corbetti* in "The Annals and Magazine of Natural History" Vol. 7, No. 38. from material obtained from the male flowers of the nipah palm in April, 1928. *G.H.C.

abdominal wall, behind which lies a dark brown sac-like object which may receive the retracted tube.

On one occasion, a fly appeared to lay its eggs in a partially open male flower, but subsequent dissection and examination proved negative, as did further examination of a number of flowers. The period of incubation is 24 hours.

Maggot. The maggots when hatched bore into the male flowers and then feed down inside the stem which they destroy, in some cases entirely with the exception of fibrous tissue. Maggots in captivity whose food was not changed, lived in stems which were rotten and showed no great desire to migrate to fresh stems when offered. There are usually two or three male flowers with very short stems surrounding the female inflorescence and, as they seem almost invariably to open before the male with long stems originating much farther down the female stem, naturally attract the flies. The short stemmed male flowers are the most dangerous since the maggots rapidly eat their way down into the female stem resulting in the death of the young fruit. The male flowers with long stems are not such a menace, as the maggots, having a long way to travel, may not reach the stem of the female flower. A full-grown maggot is browny white and about 15 mm. in length. The larval period lasts about 10 days.



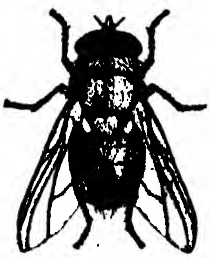
MAGGOT (x4.)

Pupa. The maggots usually pupate just beneath the surface of the earth but in some cases pupae have been found embedded in the long male stems. In the case of a palm surrounded by water, pupation would probably normally occur in the flower stem.

The pupa is about 8 mm. long, dark brown and with an eight segmented body resembling a small chrysalis. The pupal period lasts 10 days.

Flies. These closely resemble the house fly but are appreciably larger. Some are distinctly larger than others, but males and females have not been definitely identified here.

In captivity they appear to feed on pollen, but none lived long enough to give definite evidence. As remarked previously, they have so far in isolation failed to breed.



FLY (x5.)

The life cycle may thus be summarised :—

Egg—Maggot	... ...	1 day
Maggot—Pupa	... ...	10 days
Pupa—Adult	... ...	10 days
Total	...	21 days

Enemies. The flowers are aften surrounded by spider's webs and there is no doubt that these are natural enemies of the flies and act as a check on them. Owing to the remarkable protection offered by the tight sheath under which the

eggs are laid there is probably a high percentage of hatchings. Ants have, however, been observed carrying off not only eggs but newly emerged maggots.

Control. The cutting off of all male flowers, after artificially cross pollinating the female flowers, seems to be a perfectly simple and a safe means of controlling this pest.

The length of life of the maggots gives ample time for control measures to be successfully pursued with the proviso that the short-stemmed male flowers immediately surrounding the female inflorescence are removed at the earliest possible moment. The stems are often only 1—2 inches long and a mass of maggots can be seen at their base starting to feed on the female flower stem, which at an early stage is quite soft and not covered with the hard brownish skin like varnish which it later acquires.

Miscellaneous Articles.

SIXTH REPORT ON NATIVE RUBBER CULTIVATION *

The following is a translation of the "Sixth Report on Native Rubber Cultivation" in the Netherland East Indies. The report covers the period from September, 1930 to March 18th, 1931. It was prepared by Mr. A. Luytges, Chief of the Division of Agricultural Economics of the Agricultural Information Service, Department of Agriculture, Industry and Commerce.

The marked decline in rubber prices during the first eight months of 1930 continued since the middle of September but to a less degree. The lowest point was reached on October 1 and 2, when Java Standard crepe was quoted at Batavia at the rate of 18 cents per ½ kilo. This was followed by a price recovery up to 22, and 23 cents and here prices remained stable up to the middle of December. Since then, prices have been hovering at about 20 cents.

As predicted in the foregoing report, the price decline caused a considerable decrease in exports. Thus, in September, the exports of dry rubber totalled 5,248 metric tons; in October 4,442 tons; in November 5,792 tons; and in December 6,364 tons. These figures compare with the 1929 monthly average of 8,964 tons. The reduction in exports was universally caused by a decrease in production, many producers considering the prices not sufficiently profitable to justify further tapping. Some of the producers increased their stocks but this movement was not on a large scale.

The abnormally low exports of September and October must be explained as a direct result of the influence of the price fall on the interior markets. These markets react strongly to price fluctuations in proportion to the distance they are situated from Singapore, the most important rubber market. These markets react to stabilization of the world price level after a sharp decline by an increase of the price when the normal balance with the world market is re-established. Early in October, prices on the local markets of Palembang and Djambi fell to 8, 7 and even 6 cents per kilo for so-called "basah-kring" or one week old rubber. In the beginning of November, prices had increased again to 10 and 11 cents, while in the latter part of November prices of 14 and 15 cents were quoted here and there. On the other hand, blanket quotations at Singapore showed only a fluctuation from the lowest point in early October, which was 10 Straits cents per pound. From this point, prices rose to 11½ Straits cents in early November to 13 Straits cents at the end of November. This marked local price movement explains to a large extent the recovery in exports after the noticeable price decline. The creation of stocks undoubtedly also played a part in this connection. A similar course of events has been noted several times during recent years.

* We are indebted to His Majesty's Consul-General, Batavia for preparing and forwarding the translation of this important article.

In view of the gradually falling prices in December, 1930 and January, 1931, the high exports in January caused considerable surprise in many quarters. These exports amounted to 7,974 tons of dry rubber and the fact that they showed an appreciable rise over previous monthly exports may not be explained entirely by the price situation on the home markets. The January exports bring into the foreground once again the more or less uncertain element in native rubber production. We will refer to this again.

Table I in the attached appendix * gives a survey of the regional monthly exports calculated on the basis of the figures published by the Central Statistical Bureau in Maanstatistiek No. 9. These figures have only a provisional character.

Table II shows the total regional exports, divided into the three quality groups selected for the purpose of assessing the export duty. In addition, the export to Java has also been taken into account, as well as the export from Tapanoeli, on which no export duty is paid, and also the export from the free port district of the Riouw Archipelago and its Dependencies.

In view of the remarks made in the beginning of this report and the explanations made in the foregoing report, it is believed that these tables do not call for much comment. We will discuss only the changes in the dry weight percentages.

In Tapanoeli, Sumatra, West Coast, Palembang, Djambi and Acheen, the dry weight percentage has increased. For the first two regions, we must look for the cause to the fact that practically only prepared (therefore dry) rubber is still being exported because transportation charges for wet rubber from the interior are very high. With regard to Palembang and Djambi, the cause for the increase in the dry weight percentage laid in the fact that while exports of dry rubber (Group I) increased during 1930, the total exports dropped somewhat. The exports listed under Group I increased from 2,433 tons in 1929 to 3,098 tons in 1930 in the case of Palembang and from 2,558 to 2,778 tons in the case of Djambi. These increases in dry rubber exports are due to the rubber processing activities of the Netherlands Rubber Union, Ltd., with factories at Palembang and Djambi. In addition, the rubber processing factory of the Internationale Crediet—en Handels—vereeniging "Rotterdam" (Internatio) at Palembang continued its operations during 1930. The total export of Acheen decreased during 1930 against 1929, although the export of prepared rubber remained practically unchanged. In the Sumatra East Coast, Riouw Archipelago and Banka, the dry weight percentage remained almost the same. In the Western and Southwest Divisions of Borneo, however, it decreased, and especially in the Western Division. This is the result of decreased dry rubber exports, which amounted in 1929 and 1930 for the Western Division to 6,269 tons and 5,707 tons and for the Western Division to 6,269 tons and 5,707 tons

* The appendices were not forwarded with the translation. We were also not informed of the publication in which this article originally appeared. Previous articles of this nature were published in the Dutch official publication, *Korte Berichten,* and we imagine that the present article emanated from the same source.—*Ed. M.A.J.*

and for the Southern and Eastern Division to 7,433 and 5,874 tons respectively.

The total dry rubber exports (Group 1), which have steadily increased in recent years, amounted to only 22,391 tons in 1930 compared with 24,097 tons in 1929. With regard to the percentage of total exports, calculated into dry equivalent, however, the exports of dry rubber showed a relative increase, namely from 20.3 per cent. in 1928, 22.2 per cent. in 1929 to 24.7 per cent. in 1930.

An examination of graph I based on Table I will show that in 1930 exports of native rubber followed price fluctuations closely. The decrease in prices in London below 7 pence made the export decrease considerably. The export of 1930 was much lower than that of 1928 and compared with 1929 there is a decrease in exports of 16.7 per cent. If we take into account the fact that the potential production should normally increase strongly from 1930 on because the large planted extensions of the years 1924—27 will by that time have reached tapping age, then we come to the conclusion that the export and therefore also the production in 1930 decreased relatively far more than the export figures show. This may be seen from the following table, in which potential production is based on very general estimates.

Year.	Potential production in tons—dry.	Actual production (export in tons—dry).	Actual production of potential production.	Average annual Batavia quotations of standard-crepe in cts. per ½ K.G.
1927	100,000	100,491	100 per cent.	99
1928	110,000	91,353	83 ,,	58½
1929	120,000	108,584	90 ,,	54
1930	150,000	90,096	60 ,,	30¾
1931	200,000	......	......	......
1932	250,000	......	......	......
1933	300,000	......	......	......

It is interesting to compare the relative decreases in exports of native rubber from the Netherland East Indies with exports from other groups of producers and in other countries. In making comparisons, it must be remembered that the 1930 figures used in this report are based on the monthly reports and are tentative, pending publication of the final 1930 statistics. In the following table,

only the native rubber exports to foreign countries have been taken into account as reported in the monthly statistics. The export from British Malaya has been reduced and calculated into dry weight.

	Export in metric tons.			Difference in per cent. from 1929.
	1929	1930	Difference.	
British Malaya ...	459,331	447,628	— 11,703	— 2.5 per cent.
Ceylon	89,564	83,853	— 5,711	— 6.4 „
Netherland India: ... of which ...	258,406	243,678	— 14,728	— 5.7 „
Estate-rubber ...	150,849	154,758	+ 3,909	+ 2.6 „
Native-rubber ...	107,557	88,920	— 18,637	— 17.3 „

This table shows that the unfavourable market situation has especially affected the production of native rubber in the Netherland East Indies. This is easily understood inasmuch as native production stops when prices are not sufficiently high to avoid losses. It is remarkable, however, that estate rubber cultivation in this country shows a slightly larger export in 1930 compared with 1929 and this in spite of the cessation of tapping operations during May. This increased estate production must be credited to the tapping of new trees and the increased production per hectare.

It is probable that the estate cultivation in Malaya has not had a smaller production and therefore the decreased export must be credited to a smaller production on the part of native smallholders. As is shown by the figures, the decrease of Malaya is smaller than of the whole of Netherland India. From this it may be deducted that the production of the small-holdings in Malaya has been influenced probably less by the price fall than the native cultivation in this country. The causes for this difference will have to be looked for in the fact that, because of the nearness of Singapore, the greatest rubber market, and the application of another method of preparation (Chinese smoked sheet) the small-holdings of Malaya are in a more favourable production position. They form far more independent small concerns than our native rubber cultivation which is almost always run as a secondary cultivation alongside the cultivation of food products.

Previous reports have already considered the great changes which have taken place during recent years with regard to the native rubber cultivation and the increasingly difficult situation for rubber. These changes may be summed up as follows;

At the time of the boom period of 1924—27, the native population in the rubber districts was not much inclined to work, since by employing imported tappers they still were able to draw large incomes from their gardens. The continued price fall since 1927 made it unprofitable to employ imported tappers and by the second half of 1928 they had almost disappeared. Lack of funds in the interior forced the population to take charge of the tapping directly, this being done especially by the holders of small gardens. The number of such holders increased considerably in the late years because of the coming into tapping of the plantings since 1924. In the typical rubber districts, it may be said that nearly every family is in possession of one or sometimes more rubber gardens ready for tapping. It needs no further explanation than this to point out that this new position offers increasing possibilities for using local labour than was the case before.

Meanwhile prices fell to a level at which it became difficult for the larger native garden owners to obtain coolies. The former "bagi-dua" system went more and more out of use, while in part of the larger gardens production was stopped. Thus the rubber production came ever more into the hands of the owners of the small gardens.

The continued price decline in 1930 finally reached such a low level that in several districts, especially in those situated far away from the important export centres, tapping grew to be unattractive even to the small holder. Many stopped tapping with the result that the export decreased considerably.

The price recovery, as aforementioned, especially on the interior markets, stimulated production again towards the end of the year although there were other factors which also contributed to increased production during these last months. Among them undoubtedly the most important is the fact that the native population has adjusted itself to a lower standard of living brought about by lower prices in the rural districts for the necessities of life and especially of such imported items as piece-goods. In view of the lower prices for articles which the native population desires to purchase, it is now quite satisfied with present returns from the rubber cultivation which during previous years and even in the beginning of 1930 were considered insufficient for the exploitation of the gardens. By chance tests made during personal investigations carried on in Palembang, Djambi and the Sumatra East Coast, it was found that prices for the necessities of life in the rural districts have decreased strongly in recent years but especially in 1930, percentages of decrease being mentioned of from 30 per cent. to 40 per cent. and even to 50 per cent.

In view of these price decreases, it is remarkable that in a few districts tapping by local "bagi-dua" tappers, or those from the near vicinity, has started again, although the daily wage is only from 20 to 30 guilder cents and sometimes even less.

Another factor which has led to increased exports and which has undoubtedly affected the rubber export in January is the matter of paying the taxes and the so-called "road-money," the latter being a tax levied in lieu of personal

labour on certain highways constructed particularly in the Outer Possessions. The natives had to produce cash and to get cash they tap their rubber trees, produce other export products or secure jungle produce. Rubber is the article to be considered first since it may be obtained readily and without much exertion.

The "Puasa" month and the "Lebaran" (Mohammedan holidays in February) again stimulated this demand for cash and must have been one of the causes for the increased tapping and selling of stock, which led to the high exports, especially in January. In this connection, it is also announced from Palembang that much coffee from the stored stocks has also been sold. Summing up the foregoing discussion, we may say that the increase of native rubber exports since October, 1930, may be credited to the following set of factors:

(1) A slight recovery of the world market, acting in the interior as a rather important price recovery.

(2) The demand for cash for the payment of taxes and "road-money" for which purpose old stock was sold in addition to the larger production.

(3) The marked demand for cash in the "Puasa" and for the "Lebaran."

(4) The decrease in prices for the necessities of life in the interior regions. Natives are now satisfied with lower returns.

(5) The strong increase of the potential production of the native rubber cultivation because of the coming into bearing and the increase of the productivity of the large areas of young plantings which were laid out during the rubber boom from 1924—27 inclusive.

This complicated set of factors makes it almost impossible to make any accurate predictions with regard to the production of native rubber for the next few months at the price level of 20 guilder cents per half kilo. When the factor No.3—the native holidays—drops away, the others remain of influence except perhaps the continuation of the fall of the standard of living about which very little is to be said.

As to the economical position of the population of the rubber districts, it may be pointed out that now, as a result of the general extension of the cultivation of foodstuffs, sufficient food is available everywhere. In contrast to this favourable position, there is on the other hand in many places a rather serious lack of cash which finds its expression among other things in the arrears of taxes. In this matter, it is a favourable factor that most imported articles have decreased markedly in price thus making the scarcity of money not so serious.

Buitenzorg, March 18th, 1931.

Later Comments.

Mr. Luytges supplements his foregoing report on the basis of later data secured from various producing centres. The translation continues:—

Upon request the officers of the agricultural information service in the most important rubber districts expressed their opinion about the increase of the export in January. Summed up, the causes were:

1. *Djambi*—(a) Obligation to pay taxes;
   (b) Demand for money during the Puasa and to celebrate the Lebaran.
2. *Western Division of Borneo*—(a) Reaction to the higher prices in November and December; (b) Demand for cash.
3. *Palembang*—(a) The Puasa; (b) Strict collecting of money for relief from compulsory labour and taxes together with a scarcity of money.
4. *Southern and Eastern Division of Borneo.*—More demand for money because of the Puasa; (b) In many districts the rubber cultivation is the most important source of money income.

Since closing the foregoing report, the provisional figures for the March export of native rubber have become available. There has also been a considerable fall in prices on the rubber market. These facts give cause for a few minor changes in the proof of the report and for writing up the following supplement.

On the March export figures of native rubber, the cabled statements from the custom houses at Djambi, Palembang, Bandjermasin, Pontianak and Sambas are available. For the months of January, February and March they were as follows:

Export, Native Rubber, Not Reckoned by Dry Weight

(in tons of 1,000 kilos)

	January	*February*	*March*
Djambi ...	2,840	2,243	2,679
Palembang ...	1,389	1,460	1,776
Bandjermasin ...	1,450	1,090	1,447
Pontianak ...	1,766	1,408	2,053
Sambas ...	437	427	618
	7,882	6,628	8,573

The total export of native rubber calculated into dry weight in January was 7,974 metric tons. Assuming that the ratio of the rubber exports in the above-mentioned three months is equal to the ratio between the totals of the cabled statements, then it appears that the total export of native rubber calculated into dry weight must have been about 6,700 tons in February and about 8,700 tons in March.

With the exception of February, which was three days shorter than either of the other two months, it is seen that the export, notwithstanding the fact that a balanced position between the local and foreign price level must have been established, has a rising tendency, for which in the main the heavy increase of potential production and the low living standard in the interior must be considered to be responsible.

The new price fall of rubber, (the product now having reached the level of about ·16 guilder cents per ½ K.G. standard Batavia), will probably result in a new decrease in the export of native rubber, and this again in the first place because of the increased influence of the price fall in the interior; but also because, as explained in the Fifth Report, native rubber will be almost valueless at a price of about 12 guilder cents per ½ kilo standard Batavia. At present, every price fall is in percentage far heavier for the native rubber than for the standard product.

The question arises whether at this low price level the estates will also contribute to a recovery of the market by reducing the total production.

Buitenzorg, April 4th, 1931.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

First Quarter, 1931.

The Weather.—With the exception of Northern Kedah which was dry, the normal wet weather of the north east monsoon season continued in most parts of the Peninsula until the middle of January, but in Pahang it lasted until the end of the month and caused a severe flood in the eastern half of the Pahang river area. A spell of unusually hot dry weather followed, broken by occasional and local heavy showers which became more frequent in some districts towards the close of the quarter.

Prices.—The following table shows the general range of local prices reported to have been offered for rubber from small holdings in cents per kati. The corresponding price in cents per lb. has been calculated for comparison with the Singapore price for standard smoked sheet.

MONTH.	SINGAPORE PRICE. STANDARD SMOKED SHEET.		LOCAL PRICES. SMALL HOLDINGS RUBBER.			
			SMOKED SHEET.		UNSMOKED SHEET.	
	Cents per lb. Range.	Cents per lb. Average.	Cts. per kati.	Cts. per lb.	Cts. per kati.	Cts. per lb.
January ...	$11\frac{7}{8}$-$13\frac{1}{2}$	12.8	12-17	9-12.75	9-15	6.75-11.25
February ...	$11\frac{3}{8}$-12	11.9	10-15	7.50-11.25	8-13.50	6-10.13
March ...	$10\frac{3}{4}$-$13\frac{3}{8}$	12	11-17	8.25-12.75	8-14	6-10.50

In addition there is a market for scrap and lump rubber at average prices of about 4 to 5 cents a kati. The prices vary in different districts from as low as 1.50—2 cents up to as high as 6 to 8 cents a kati.

The reports show considerable range each month in the local prices for rubber from small holdings. Several factors have an effect on local prices among them may be mentioned:

(*a*) quality of the bulk of the local rubber;
(*b*) distance from a central market;
(*c*) speculation among local small rubber dealers;
(*d*) the amount of competition in the local buying centre.

During February buyers were able to take temporary advantage of the anxiety of small holders to sell, in order to obtain cash for the Mohamedan and Chinese New Year holidays, and so to depress the local prices below the normal rates indicated by the Singapore price.

General.—Wintering commenced at the end of January and continued throughout the dry weather in February and March. At the end of the quarter

it was practically completed and the flush of new leaves was developing, except in Singapore island where leaf fall was late. The leaf fall was by no means so simultaneous throughout the country, so uniform in each locality or so heavy as in 1930.

Another factor liable to influence rubber production during the quarter is that in most parts of the country small holders were busy reaping the padi harvest and in consequence, where tapping coolies are no longer employed, the trees are liable to have been left untapped.

Owing to large crops in other parts of the world, notably Burma, the price of rice is unusually low. This is an advantage to all small holders, except those in the large padi growing areas such as Krian and Kedah who are, at least in part, dependant on the sale of their surplus padi.

There is a tendency among Malay small holders to take an interest in crops other than rubber more especially food stuffs, such as hill padi, maize and tapioca. Considerable areas of such crops have been planted in parts of Pahang and in Kedah.

Upkeep of Holdings.—In Selangor the general upkeep of small holdings is still neglected. In Pahang West during the dry weather some holdings were cleaned up by those owners who could afford to do so. This work usually took the form of strip-weeding which had the added advantage of preventing soil erosion in the hilly parts of the State. In Singapore island it was noticed with some surprise, that during March expenditure was incurred by owners of certain small holdings and small estates on eradicating lalang grass and bush. The reason for this change in policy is not understood.

Tapping. It was reported that in Pahang West during January the wet weather and the continued low price of rubber combined to cause a further increase in the number of untapped holdings during the month. In Singapore island during the same month a large percentage of small holdings remained untapped. It has, however, been noticed that with any slight rise in price tapping is temporarily renewed on a few of the holdings, but is stopped as soon as the price again falls. Conditions in Singapore island showed no change during the quarter.

It was noticed in Pahang West during February that a considerable number of Chinese ceased tapping for a period of 7 to 10 days including the Chinese New Year, while it is recorded from Selangor in March that some of the larger Asiatic properties have temporarily gone out of tapping. On the other hand, in the Negri Sembilan during February tapping was resumed on many areas of small holdings on which it had been stopped some months previously.

According to comments from Selangor and Johore, tapping has continued to be severe, while in the latter State during March the trees were frequently tapped by lamp-light before day-break.

There are indications that in some other parts of the country, more especially where the owners are entirely dependant on rubber and own no padi land, tapping may be severe and the rate of bark removal excessive. Opinions at

present vary considerably as to the extent of such excessive bark removal and as to its effect on future production.

Yields.—In Pahang West during March it was recorded that the combined effects of wintering and the prolonged draught had considerably depressed yields.

Diseases.—(a) Mouldy Rot. The wet season, as usual, produced a vigorous recrudecence of Mouldy Rot Disease in all previously infected areas, while infection was conveyed to a considerable number of new centres by tappers dismissed from infected localities. It has been noticed on other occasions that the spread of the disease to previously unaffected areas occurs much more rapidly when low prices cause a number of tappers to move about the country in search of employment. During January and part of February control of Mouldy Rot called for careful attention, and necessitated the employment of additional temporary staff in Perak South and parts of Selangor. With the advent of drier weather the fungus became much less prevalent.

Arrangements have been made to establish a list of approved disinfectants for the treatment of this disease. Before inclusion in the list each preparation will be tested by the Rubber Research Institute, the cost of the test being borne by the manufacturers.

(b) Oidium leaf mildew. Minor outbreaks of Oidium disease causing abnormal leaf fall have been reported from a number of estates in various districts. In the districts on the Negri Sembilan—Malacca border and in Malacca, in which severe outbreaks occured on small holdings after the wintering season in 1930, only minor outbreaks have been observed this year. It is not anticipated that any control measures will be necessary owing to the mild attack and rapid recovery.

Budwood.—While imports of budwood, though decreasing, still continue, this budwood is not as yet used on small holdings. A few Malay and Chinese owners of small holdings are, however, interested in budding, as is evinced by the letters of enquiry regarding supplies of budwood and its correct use, which have been received both by the Rubber Research Institute of Malaya and the Department of Agriculture.

Reviews.

An Economic View of Rubber Planting.

BY

R. SOLIVA,

137 pp. Kelly and Walsh, Ltd., Singapore, 1931. Price $3.00 post free.

This brochure contains an interesting and valuable review of several aspects of the plantation rubber industry in the Netherlands East Indies, Ceylon and Malaya.

Although essentially, as stated in the title, the information is of an economic nature and deals with estate costs and yields, the author also discusses methods of cultivation, factory practice and methods of preparation.

The author makes fairly accurate statements and shows good powers of observations in most instances while in others the statements are somewhat inaccurate e.g. on page 14 he remarks that sandy soils for the cultivation of rubber should be avoided on account of the fact that they favour the spread of Fomes (lignosus) which is correct, while on page 13 he describes the coastal alluvial clays as containing a high percentage of sand. This certainly does not apply generally to the blue-grey coastal clays in Malaya on which rubber is planted.

Nor is his statement on page 15 that "the alluvial coastal districts are left to the Native" correct in relation to rubber cultivation, e.g. the large areas of alluvial soil in the Klang, Kuala Selangor, Kuala Langat districts of Selangor.

On page 15 the author also appears to suggest that the high yields of small-holdings are due to the fact that they are planted on low lying land.

On page 17 the "dry season at the end of the year" should read "the dry season at the beginning of the year."

The information given on page 19 on budding is not very accurate in relation to the clones which are being used, while the figures of budded areas in Malaya are too low.

Under "Miscellaneous" on page 20, no mention is made of the preparation of concentrated latex known as Revertex which was commenced in Malaya long before the centrifugal process of concentration mentioned on the same page, (Reference is made on page 62 to the manufacture of Revertex on the R.C.M.A. Estates in Sumatra although this was commenced only recently), while the Spray Rubber Process has not been carried out in Malaya.

Again on page 21, the bark consumption on European estates in alternate daily tapping is given as 15-20 inches per annum which is far in excess of the amount removed by this system of tapping.

The section on costs per acre of bringing rubber into bearing may be taken as fairly reliable, but much will depend on the cost of labour.

While the cost of production figures per lb. of rubber given in Section VII for 1929 are fairly correct, the author has not realised how much these have been reduced during 1930.

Turning to the Section on the Netherlands East Indies the author's observations and remarks in relation to budded areas and areas planted with selected seed are of considerable interest and are probably accurate. They indicate that the areas planted with "proved" clones are not much in excess of the area already planted in Malaya, due to the fact that poorer yielding clones, since discarded, were planted by the pioneers.

It is doubtful whether the figures shewing higher costs of bringing rubber into bearing in Malaya compared with Sumatra as given on pages 72 and 73 are reliable, except that it has to be borne in mind that labour costs in Malaya on a dollar basis (2/4) compared with the florin (1/8) in the Netherlands East Indies must affect such costs, since the rates of pay of labour in cents (dollar) and cents (florin) are approximately similar. At any rate, some of the figures are open to considerable criticism.

Recent figures for cost of production in Malaya do not support the author's contentions on page 80 that cost of production is higher in Malaya than in Sumatra.

The reviewer has been shown recently a number of records of estate costs and has also discussed such costs with various authorities in Sumatra.

In relation to Ceylon the author makes no reference to the difference in tapping methods in Ceylon, compared with Malaya and the Netherlands East Indies. In Ceylon a very thin slice of bark per tapping is removed whereas in the other countries it is considered that such a practice decreases yields and is more liable to induce Brown Bast disease.

On page 93 the author refers to the milling of crepe rubber in Ceylon as being of a high standard. On most estates, however, in Ceylon, blanket crepe built up from a hot airdried lace crepe is manufactured and this does not require the fine milling which is essential in Malaya and Netherland East Indies for the manufacture of thin pale crepe. The finest crepe, as far as appearance is concerned, is undoubtedly prepared in Sumatra and Java.

The reviewer has not made the above criticisms in order to detract from the value of the book, which contains a vast amount of useful information in a small space. These criticisms would, however, have been unnecessary if the author had submitted his material to a few individuals or institutions to be edited.

The book can be recommended to all producers in the East and others who are interested in the plantation rubber industry in the countries with which the author deals.

The author in his preface craves the indulgence of the reader for technical errors, as he is a Banker and not a Planter. In spite of these technical errors, to some of which attention has been drawn in this review, the author shows that he possesses quite a good knowledge of the most important aspects of the industry and is capable of "appreciating the situation."

B. J. E.

Report on the work of Agricultural Research Institutes and on certain other Agricultural Investigations in the United Kingdom 1928—1929.

230 pp. Appendix and Index. London. H.M. Stationery Office Wyman and Sons Ltd., 1930.

Agricultural investigations conducted in temperate climates must, of necessity, have but a restricted application to tropical conditions. The summary of research work presented in this volume, compiled primarily for the information of the Council of the Ministry of Agriculture and Fisheries, London, might on these grounds be considered unsuited for review in a journal circulating in tropical countries and concerned with tropical crops and conditions. But there is much research work of a fundamental nature which finds its place in these Reports, and which is of value, not only to research workers, but to the practical agriculturist in the tropics.

Disregarding, therefore, the portions which deal with the conditions of growth and the diseases and pests of temperate crops, the volume still contains much that is of interest and value in tropical agriculture. We cannot, for instance, neglect the advances of science in relation to the breeding, diseases and physiology of cattle, although the information on feeding must be treated with greater caution when considering its application in a country such as Malaya. But even in cattle feeding, fundamental principles are evolved which must materially affect any preconceived ideas even under conditions widely dissimilar to those under which the actual experiments were conducted. We would instance the work of the Rowett Research Institute, Aberdeen, on the influence of minerals on the development and health of animals and that on nutrition and disease.

Turning for a moment to another aspect of agricultural practice; planters in the tropics cannot afford to ignore the valuable contributions to our knowledge on agricultural economics, and particularly to the application of the principles underlying this important branch of agriculture. The selection of methods of reducing costs of production and the degree to which such methods can be applied are of paramount importance at the present time. In this connection, the results achieved in the United Kingdom cannot be ignored by tropical agriculturists.

In soil research, mycology, entomology and in agricultural engineering much can also be applied to tropical conditions.

The reviewer is not attempting to offer an apology for the inclusion of this review on a book treating with temperate zone conditions of agriculture; still less does he wish it to be understood that the Reports to which he refers give the results of the scientific research of the United Kingdom during 1928 and 1929. For the most part, the publication refers to the lines of research conducted throughout the United Kingdom, from which the enquirer can readily get in touch with the particular institution concerned with any aspect of agricultural research. He will find much assistance from the Appendix and Index provided. The volume is therefore recommended as a book of reference which should assist agriculturists in keeping up-to-date in matters affecting their profession.

D. H. G.

The Behaviour and Diseases of Banana in Storage and Transport

BY

C. W. WARDLAW AND L. P. MCGUIRE.

67pp. 29 figs. Appendix and Index. Empire Marketing Board 36. January, 1931. London: His Majesty's Stationery Office. Price 1s. 0d. net.

The research dealt with in this publication was carried out by the authors at the Low Temperature Station, Imperial College of Agriculture, Trinidad, B.W.I.

Panama Disease, which first appeared in Central America in 1903 has caused heavy losses in the West Indies and has been responsible for the abandonment of thousands of acres of plantations. In view of the fact that the export of bananas from the British West Indies amounts to about £2,000,000 annually, the success of the research work indicated above is of great moment to the Empire.

The prevalence of Panama Disease, to which the Gros Michel banana, the chief variety of commerce, is susceptible has not only necessitated a study of the disease in question, but also the breeding of suitable immune or highly disease resistant hybrids and the selection of the most suitable varieties of proved immunity or high resistance. In addition it has been necessary to determine the precise set of conditions suitable to the successful transport overseas of each such hybrid or variety and to its subsequent ripening to an attractive colour.

The principal causes of wastage in banana shipments are due to main-stalk rot resulting from the attacks of various fungi diseases, and "finger dropping," which may be due to the advanced stage of main-stalk rot, to mechanical injury to individual fingers, or to late maturity.

The Gros Michel, Lacatan and Cavendish were found to be varieties of decided value. The earlier trials established the following facts:—correlation between the conditions in respect of soil and climate under which the fruits were grown before storage and the behaviour in storage and ripening; excessive tenderness and susceptibility to bruising usually attributed to the Cavendish variety and believed to necessitate its crating were not confirmed, careful handling obviating the major objection of breaking off of fingers; and thirdly, much of the irregular colouring up of fingers and premature ripening of lower hands was found to be due to fungal attack as a result of insect punctures or mechanical damage during harvesting and transport.

There is a wide range of maturity at which the Cavendish variety may be picked, so that it will stand, uncrated, the usual bulk storage conditions for as long as 18½ days. While on being ripened it has not the rich hue of the Gros Michel, the better and more vigorous bunches were extraordinarily systematised and attractive, especially before the onset of freckling, concomitant with late maturity in this variety. If these results are confirmed in later storage trials, a hopeful note may be sounded regarding the possibilities of the West Indian Cavendish as a substitute for the Gros Michel.

Experimental work on various fungi was carried out to determine the general behaviour of such infection on the banana under commercial storage conditions. Such infections were considered from the point of view of the rate of growth of the fungi at different temperatures and their parasitic behaviour as determined by inoculation experiments.

As a preliminary, observations on the rate of growth of six fungi affecting the banana were carried out by culturing the fungi. In this manner the rate of growth of fungi at different temperatures was ascertained, an important consideration in connection with these investigations.

Inoculation experiments with various fungi were carried out to observe the effect of each fungus on the bunch. The diseases that have been studied in this connection are *Thielaviopsis paradoxa* (Von Hohned); *Gloeosporium musarum* (Cooke and Massee); *Botryodiplodia theobromae* (Pat); and *Fusarium spp.*

It was found that wastage in banana cargoes or in stored fruit is due mainly to the activities of a number of fungi or moulds. These are responsible for an important downward rotting of the main-stalk, for "finger dropping" and the blemishing and rotting of fruit. Infections may become established in the field or during storage. Rough handling of fruit with the consequent bruising greatly accentuates the amount of disease. Further, temperature plays an important part in the growth activities of moulds. Low storage temperatures curtail the amount of disease.

The next stage in the investigation was to consider the nature and incidence of diseases in large consignments of fruit during ocean transport.

For some years main-stalk rot has been prevalent in cargoes on arrival at the English port. It was found that the length of time that elapsed in ships before refrigeration of the cargoes encouraged the early development of main-stalk rot.

The authors recommend the following to reduce losses attendant on main-stalk rot. Firstly, cutting stalks long—about 10 inches—when reaping bunches. Secondly, that after inspection at quay side the stems be fresh cut with a sharp instrument and thoroughly treated with vaseline. In this way the fungal organisms which have become established in the long interval between reaping and loading will be eliminated. Thirdly, commencing refrigeration as soon as possible after loading, and fourthly, rapid cooling of the cargoes.

The use of brown paper in other countries for the transport of bananas has made it possible to ensure that the fruit shall arrive at its destination with the minimum of blemishes. The use of such bags, however, affects very materially the composition of the air around the fruit and the temperature of the fruit itself. These factors may affect the fruit considerably with serious consequences, especially when the ship is delayed. The danger from these causes was obviated to a large degree by punching holes ⅜ inch diameter, set 4 inches apart. A comparison of the condition of the fruit in bags so treated with untreated bags demonstrated that while over 60 per cent. of the bunches in the unpunched bags shewed acute

main-stalk rot, there was an incidence of 6 per cent. only in the corresponding punched set. Furthermore, cooling with the latter method was more rapid.

Bananas for certain markets are cut into hands and crated. This tends to uneven and more rapid ripening. As a result of investigations, the authors emphasise the necessity for careful selection of fruit at the correct stage of maturity; shortening as much as possible the interval between harvesting and transference to the cool storage chamber; thorough pre-cooling of the whole bunch prior to cutting into hands and the application of vaseline for journeys of ten days or longer; rapid transference, in insulated conveyors if necessary, from the pre-cooling station in to the ship's hold; the maintenance of a temperature of 50°F.—55°F. in the case of Cavendish and Gros Michal varieties; the complete change of the storage atmosphere at least once per day; the use of "dunnage" on crates, and the provision of vertical breaks in the cargo stacks, when these are large.

The appendix to this volume gives a review of the literature on fungal diseases of banana fruits.

D. H. G.

The Feeding Value of Para Rubber Seed Meal.

The problem of the utilisation of Para rubber seed meal as a feeding stuff has been under consideration for many years. Trials carried out with the cake for feeding cattle and sheep by the South Eastern Agricultural Collage at Wye, Kent, proved that it might be successfully used for this purpose.

The question has again been recently considered at the Virginia Agricultural Experiment Station, where feeding trials with Para rubber seed meal have been conducted with dairy cows to ascertain its value for milk production and the digestibility of its constituents. The results of these experiments are reported in *Technical Bulletin, No. 41* April 1931, *Virginia Agricultural Experiment Station.* The trials have indicated that Para rubber seed meal may be used as a medium protein concentrate in rations for dairy cows. It is palatable, neither laxative nor constipating, and is apparently equal to linseed meal in supporting milk production. It is suggested that, whenever available at a reasonable price, rubber seed meal of good quality might be profitably used as an ingredient in the rations of dairy cows.—*Bulletin of the Imperial Institute Vol XXVIII No. 4 1930.*

Departmental.

FROM THE DISTRICTS.

The Weather.

In general the weather during the month was normal for the season, that is, fairly hot in the mornings with frequent and often heavy showers or thunderstorms in the afternoons, more especially during the second half of the month. In Pahang, conditions may more fairly be described as hot and dry.

Remarks on Crops.

Rubber.—Local prices for rubber from small holdings again declined, being \$8—\$14 per picul for smoked sheet, \$6—\$12.75 for unsmoked sheet and \$3—\$6.50 for scrap. It is remarkable that there is still a market for scrap and other low grades of rubber and at comparatively steady prices which do not fluctuate in sympathy with those of the higher grades.

There was an increase in the number of untapped rubber holdings in the Settlement of Penang, in Selangor and the Negri Sembilan. In the latter State the owners were mostly engaged on preliminary work in their rice fields.

The somewhat irregular wintering had terminated or nearly terminated at the end of the month.

Oidium Leaf Mildew reappeared over a considerable area in the Negri Sembilan and Malaccca where it was also present in 1930. Reports of outbreaks were also received from a few estates in Selangor and Perak and from several in Province Wellesley. The attack was confined to the young leaves on the later wintering trees. Towards the end of the month heavy showers of rain appeared to check its spread and in no case was the attack sufficiently serious to call for control measures. The infected areas in the Negri Sembilan and Malacca were inspected by an officer of the Pathological Division of the Rubber Research Institute in company with the two Agricultural Field Officers concerned.

The showery weather caused a recrudescence of Mouldy Rot disease in parts of Southern Perak and Selangor where control measures received careful attention. Elsewhere the disease was not in evidence.

In Kedah a somewhat serious outbreak of a leaf spot disease, caused by *Helminthosporium Heveae*, occurred on certain estates, mainly on young foliage.

Padi.—By the end of the month the padi harvest for the season 1930—31 was practically completed. The yields in Kedah and Province Wellesley were good. The crop in the Dindings was destroyed by drought.

Preliminary work for the coming season's crop had been commenced in the inland Districts of Perak South, along the Pahang River, in Selangor, the Negri Sembilan and Malacca.

The padi in the Sabak Bernam District is nearly all planted as a catch crop with coconuts, until the latter are from 3 to 4 years old. Consequently, there is likely to be a rapid annual diminution in the planted area.

As a result of the visit of the Propaganda Caravan, over 1,000 gantangs of seed padi of various strains have been purchased by applicants in the Negri Sembilan at 10 cents a gantang.

In Selangor the stem borer, *Schoenobius incertellus*, was found attacking nursery seedlings only twelve days old. Stem borers were also found to be numerous in the stubble and volunteer padi in the sub-district of Sabak Bernam.

Coconuts.—In Selangor the decline in crops and in copra content of nuts reported in March continued during April. In the same State an outbreak of the nettle caterpillar, *Setora nitens*, at Pulau Lumut was satisfactorily controlled by hand picking.

Fruit.—Pineapples are being planted in the Kulim District and fruit trees and bananas in the Northern Districts of Kedah. The common native fruit trees such as the durian, mangosteen, rambutan and horse mango were in flower in Kedah, Province Wellesley and Penang. Cashew nuts were plentiful in the two latter localities. Heavy crops of bananas and pineapples were obtained in Province Wellesley South, while from the Jelebu District of the Negri Sembilan between 40 and 50 tons of bananas were despatched for sale in Seremban and Kuala Lumpur. In Selangor the price of pineapples for canning varied from 50 to 80 cents per hundred.

Coffee.—There was considerable variation in local prices for coffee, 10 to 11 cents a kati (1½ lbs.) being given in Temerloh District and 16—20 cents in Raub District of Pahang, while in Selangor the price in the coastal Districts was between 10 and 14 cents, but in Ulu Langat District 15 cents a kati.

An outbreak of the Coffee Hawk Moth *Cephanodes hylas* at Bukit Kapar in Selangor was successfully controlled by hand picking, but similar measures in Kuala Selangor District were not so thoroughly executed.

Tea.—In Selangor there was a further decline in the price of local Chinese tea, the first grade selling for 48 cents a kati as compared with 50—55 cents during March.

During last year, demonstrations at the Government Experimental Plantation, Serdang, were given by the Chinese Sub-Inspector of Agriculture to Chinese tea growers from Sungei Balak. The growers have been quick to profit by the knowledge so gained, as is shown by the improvement in methods of soil convervation and in pruning now practised on their holdings.

Notes on Demonstration Stations and Padi Test Plots.

The Padi Test Plot at Glugor in Penang was planted with six strains of short duration padi to test the possibility of obtaining two crops of padi a year where a good supply of irrigation water is obtainable.

The new layout of the Demonstration Station at Kuala Kangsar was completed in readiness for planting. Good progress was made in developing the new Station at Sungei Udang in Malacca, while work was commenced on three other new Stations at Rembau in the Negri Sembilan and at Kuantan and Temerloh in Pahang.

School Gardens.

Progress was made in replanting the beds in most gardens. Distributions of planting material were made by the Department in Pahang. Cultivation and general arrangements show improvement in many gardens.

Propaganda Caravan.

During the month the inter-departmental propaganda caravan visited various centres in the sub-district of Tanjong Malim in Perak and Ulu Selangor District in Selangor. Exhibits of departmental pedigree strains of padi, padi stem borers, and rat destruction methods were used to illustrate a lecture in the afternoons; while at night, a lantern lecture on Mouldy Rot Disease of rubber was given and the Malay cinematograph film on the subject of co-operation was projected.

Rat Destruction.

In Province Wellesley 385,616 rat tails were collected, mostly from nests in the bunds of padi fields, though nests are reported to be fewer this year than in previous seasons. In Krian 67,580 tails were obtained and a stock of poisoned bait was prepared in readiness for the coming season. It has been decided to discontinue the payment of rewards for tails in these two areas after the 15th. May next, but to continue the supply of traps and poisoned baits and to encourage padi growers to make use of these to protect their crops from damage.

In Malacca the campaign is being continued on the same lines as formerly, except that the reward will be reduced to 1 cent for 4 tails during the inter-crop season. During the month 124,800 tails were collected. Interest in this work is growing as is evinced by the progressive increase in the monthly catches.

DEPARTMENTAL NOTES.

Visits of the Director.

The Director of Agriculture, S.S. and F.M.S. visited Malacca on April 6th. and 7th. He inspected the Pulau Gadong Padi Experiment Station, including the new pumping plant, and also the new experiment station at Sungei Udang. Various matters were discussed with the Hon'ble Resident Councillor, Malacca, and the Agricultural Field Officer.

A visit of inspection to Fraser's Hill was made from 18th. to 20th. in connection with the new Dairy Farm.

School of Agriculture, Malaya.

The Chief Secretary to Government, F.M.S., has appointed an Advisory Committee for the Government School of Agriculture, Malaya, Serdang, constituted as follows :—

The Director of Agriculture, S.S. and F.M.S. (*Chairman*);
The Director of Co-operation, F.M.S. and S.S.,
The Director of the Rubber Research Institute;
The Chief Inspector of English Schools, S.S. and F.M.S.;
The Hon'ble Mr. J. S. Arter;
The Hon'ble the Undang of Rembau;
The Hon'ble Mr. Tan Cheng Lock;
The Hon'ble Mr. Veerasamy;
The Vice-Principal of the School (*Secretary*).

(Notification No. 3208, F.M.S. Government Gazette Vol. XXIII, No. 9 24th. April, 1931.)

Official Opening of School of Agriculture, Malaya.

The official opening of the School of Agriculture, Malaya, will be performed by H. E. The Officer Administering Government and Acting High Commissioner for the Malay States, Mr. John Scott, C.M.G., at 4.30 p.m. on Thursday 21st. May, 1931.

Leave.

Mr. F. S. Banfield, Horticultural Assistant, has been granted seven months and eleven days' leave on full pay with effect from the 21st. February, 1931, inclusive.

Mr. J. Lambourne, Assistant Agriculturist, has been granted nine months and seven days' leave on full pay with effect from the 4th. April, 1931, inclusive.

Mr. C. L. Newman, Agricultural Field Officer, has been granted seven months' leave on full pay with effect from the 11th. April, 1931, inclusive.

Mr. F. G. Spring, Agriculturist (Rubber) seconded to the Co-operative Department, has been granted seven months and twenty-four days' leave on full pay with effect from the 13th. April, inclusive.

Mr. J. H. Dennett, Assistant Chemist, has been granted ten months' leave on full pay with effect from the 18th. April 1931, inclusive.

Mr. R. B. Jagoe, Assistant Economic Botanist, has been granted nine months and six days' leave on full pay with effect from the 2nd. April, 1931, inclusive.

Staff Changes.

The following staff changes were effected from 11th. April, 1931.

Mr. R. G. Heath, Agricultural Field Officer, Pahang West, transferred to Malacca to act as Agricultural Field Officer, Malacca.

Mr. J. Fairweather, Acting Agricultural Field Officer, Province Wellesley and Penang replaced Mr. Heath in Pahang West.

Mr. H. J. Simpson, Agricultural Field Officer, Perak South was transferred. to act as Agricultural Field Officer, Province Wellesley and Penang.

Inche Arifin bin Haji Abas, Senior Agricultural Assistant, Batang Padang, was appointed to act temporarily as Agricultural Field Officer, Perak South.

Statistical.

MARKET PRICES.

April, 1931.

Rubber.—The rubber market has experienced a still further steady decline in prices during the month, a new lowest level on record being established on the last two days of the month, when the Singapore price was 8⅜ cents per lb. and the London price 2 13/16d. per lb. The average price for April in Singapore was 9.7 cents per lb. and in London 3.3d. per lb. compared with 12 cents and 3.8d. respectively for March.

Palm Oil.—A London correspondent writing on 5th. March stated that he doubted whether Malayan oil in barrels would make £20 per ton c.i.f. (i.e. £15 ton f.o.b.) The Sumatran product has also declined. On the other hand, West African is now more in line, while the premium for Malayan is not so great. Writing from London on 9th. April this correspondent wrote: "April shipment is not worth more than £19-10-0 c.i.f. to-day. Consumers are right out of the market. Oils and oil seeds generally seem to be slipping back a little, and no doubt Palm Oil is following in sympathy."

Copra.—The market has declined throughout the month and supplies are coming in freely. The highest price for sun-dried was $5.80 per picul, the lowest $5.55 per picul. "Mixed" highest price was $5.40, lowest $5.15 per picul. Average Singapore prices for April were; Sun-dried $5.58 compared with $5.97 in March; Mixed $5.33 compared with $5.58 per picul for the previous month. Copra cake remained at around $1.60 per picul.

Pineapples.—The canned pineapple packing factories have been working at high pressure. There has been a good demand for ready delivery, but buyers are only interested in forward positions at very low prices. Average prices per case in Singapore for April were:—1½ lb. cubes, $3.20; 1⅝ lb. sliced flat, $3.05; 1½ lb. sliced tall, $3.36. Corresponding figures for March were $3.28, $3.14, and $3.42.

Tapioca.—A collapse has taken place on the market due to poor demand at wretched prices and all grades have suffered thereby. Flake, fair has dropped from $4.10 to $3.10 per picul, the average price for the month being $3.59 per picul against $4.20 for March. Pearl, seed declined from $5.25 to $4.50 per picul, the average price being $4.81 compared with $5.25 in March; while Pearl, medium, experienced a decline from $6.00 to $5.00 per picul, the average price being $5.50 per picul compared with an average of $6.00 for March.

Sago.—The demand has been extremely limited. Prices were maintained early in the month by Japanese buying, but by the end of the month arrivals were more than sufficient to meet present requirements, and the price of sago flour dropped to the lowest on record ($1.87½ per picul). Average Singapore prices in April: Pearl, small, fair $4.94; Flour, Sarawak, fair, $2.15 per picul. Corresponding prices in March were $5.75 and $2.44 per picul.

Coffee.—Singapore prices for Java Robusta have varied from $19 to $16.50

per picul on a falling market. The average price for this grade was $17.75 per picul. Palembang coffee has also declined from $12.65 to $11.75, the average price for the month being $12.14 per picul.

Areca nuts.—Prices for this commodity are still declining on the Singapore market. This applies especially to the "Red whole" as the Saigon demand is very flat. Average prices per picul of the various descriptions were as follows:—Palembang whole, $6.14; Bila whole, $5.37; sliced, $13.92; Red whole, $5.75; Split, $5.25; Kelantan split $6.15.

Rice.—Singapore prices for imported rice have remained fairly steady throughout April. Average prices per coyan were as follows:—Siam No. 2., $164; Saigon No. 1, $153; Rangoon No. 1, $135. The corresponding prices for the previous month were $165, $154, $139.

Gambier.—After many months of a featureless market, there is now more interest in this product and business has passed at comparatively high prices. Average Singapore prices for April were:—Block, $11.31 against $9.75 per picul in March; cube No. 1., $15.37 compared with $15 in March.

Pepper.—Singapore market easier with buyers, for the most part, disinclined to operate. Average prices per picul in April:—Singapore, black, $20.31; Singapore, white, $34.56; Muntok white, $35.56. Prices for March were $21.00; $38.50; $39.75 per picul respectively.

Cloves.—Average Singapore prices in April were; Zanzibar, $50.25; Amboina, $48.62 per picul. The corresponding prices for March were $62 and $59 per picul.

Nutmegs.—Average prices in Singapore for the month were, for 110 per lb. $20.87 per picul; 80 per lb., $25.87 per picul. Corresponding prices in March were $23.37 and $27.75 per picul.

Mace.—Average Singapore prices for April: Siouw, $64.50 per picul against $79.75 in March; Amboina $47.00 per picul against $59.50 per picul in March.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in April, and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd., and reports on the Singapore prices for Coffee and Areca nuts by the Lianqui Trading Company of Singapore.

1 picul = 133 1/3 lbs. 1 coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

MALAYA RUBBER STATISTICS.

Areas untapped during the month of January, 1931.

Estates of 100 Acres and over.

Territory.	Total area of Estates entirely ceased tapping.	Total area rested.	Total area not tapped.
	Acres.	Acres.	Acres.
Perak	2,811	35,045	37,856
Selangor	3,549	50,839	54,388
Negri Sembilan ...	5,580	25,068	30,648
Pahang	5,199	5,122	10,321
Total F.M.S. ...	17,139	116,074	133,213*
Malacca	1,212	22,745	23,957
Province Wellesley ...	1,779	11,592	13,371
Dindings	......	1,809	1,809
Singapore	5,841	3,152	8,993
Penang	691	107	798
Total S. S. ...	9,523	39,405	48,928*
Grand Total ...	26,662	155,479	182,141

*Of the total Federated Malay States area of 133,213 acres 32,373 acres were rested due to the adoption of the A.B.C. system of tapping and that of the total Straits Settlements area of 48,928 acres 10,804 acres were similarily rested.

Areas untapped during the month of February, 1931.

Estates of 100 acres and over.

TERRITORY.	Area of Estates entirely ceased tapping.	AREAS RESTED.		Total area untapped.
		Out of tapping pro-tem.	Due to adoption of A.B.C. system of tapping.	
	Acres.	Acres.	Acres.	Acres.
Perak ...	1,789	25,707	11,251	38,747
Selangor ...	5,176	34,782	17,761	57,719
Negri Sembilan...	8,923	28,042	1,316	38,281
Pahang ...	1,186	5,243	......	6,429
Total F.M.S.	17,074	93,774	30,328	141,176
Province Wellesley ...	1,977	6,521	3,608	12,106
Dindings ...	......	1,873	......	1,873
Malacca ...	2,273	21,235	4,359	27,867
Penang ...	584	693	......	1,277
Singapore ...	3,148	11,008	......	14,156
Total S.S.	7,892	41,330	7,967	57,279
Grand Total.	25,066	135,104	38,295	198,455

Areas untapped during the month of March, 1931.

Estates of 100 Acres and over.

TERRITORY.	Areas Rested. Total areas of Estates which have entirely ceased tapping.	Areas Rested. Areas on Estates partly out of tapping Pro-tem.	Total area Untapped *
	Acres.	Acres.	Acres.
Perak	9,701	25,191	34,892
Selangor	6,370	37,915	44,285
Negri Sembilan ...	8,031	28,449	36,480
Pahang	5,924	5,262	11,186
Total F.M.S. ...	30,026	96,817	126,843
Province Wellesley ...	3,378	6,402	9,780
Dindings	......	1,548	1,548
Malacca	2,014	23,007	25,021
Penang	1,142	138	1,280
Singapore	6,747	7,280	14,027
Total S.S. ...	13,281	38.375	51,656
Grand Total ...	43,307	135,192	178,499

* Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. and S.S. during March (not included in the above figures) were :—

F.M.S.	...	36,035 Acres
S.S.	...	8,665 „
Total	...	**44,700** „

J. GORDON-CARRIE,
Deputy Registrar-General of Statistics,
S.S. & F.M.S.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MARCH, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	during the month: Foreign	during the month: From Malay States	during the year 1931: Foreign	during the year 1931: From Malay States	during the month: Foreign	during the month: Local	during the year 1931: Foreign	during the year 1931: Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES:—																		
Federated Malay States	...	15,016	15,129	11,447	35,098	10,235	29,546	Nil	17	Nil	26	15,327	8,033	41,747	22,095	14,788	13,696	...
Johore	...	2,307	4,712	3,702	10,763	4,319	12,610	Nil	3	Nil	5	722	7,652	1,956	21,599	2,252	4,417	...
Kedah	...	364	2,406	1,648	6,101	973	3,373	Nil	Nil	Nil	Nil	774	2,331	2,040	8,197	332	1,954	...
Perlis	...	5	9	8	23	12	39	Nil	Nil	Nil	Nil	Nil	19	Nil	68	9	6	...
Kelantan ...	...	224	82	164	561	750	1,632	2	Nil	9	Nil	100	715	209	1,797	299	108	...
Trengganu ...	..	55	50	134	287	67	143	Nil	Nil	Nil	Nil	Nil	201	Nil	430	55	50	...
Total Malay States	...	17,971	22,388	17,103	52,833	16,356	47,343	2	20	9	31	16,923	18,951	45,952	54,186	17,735	20,231	...
STRAITS SETTLEMENTS																		...
Malacca ...	...	3,518	1,658	1,164	3,494			Nil		Nil		5,841		16,280		2,827	1,416	...
Province Wellesley	...	118	564	342	1,266			Nil		Nil						96	428	...
Dindings ...	...	152	125	94	294			Nil		Nil						172	96	...
Penang	1,877	5,047	10	5	24	(2) 2,000	(2) 6,000	832	18,931	2,441	54,155	5,874	Nil	18,415	Nil	5,716	5	1,907
Singapore ...	3,301	34,151	311	205	573			8,973		24,310		19,951		51,472		35,506	316	2,076
Total Straits Settlements	5,178	42,986	2,668	1,810	5,651	2,000	6,000	9,805	18,931	26,751	54,155	31,666	Nil	86,167	Nil	44,317	2,261	3,983
TOTAL MALAYA	5,178	60,957	25,056	18,913	58,484	18,356	53,343	9,807	18,951	26,760	54,186	48,589	18,951	132,119	54,186	62,052	22,492	3,983

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	11,467	20,456	4,074	2,149	867	39,013
Crepe	660	11,491	1,374	794	180	14,499
Unsmoked sheet }	1,597	} 3,559	268	152	(734	} 7,854
Scrap and lump }	1,064				471	
Total all Grades	14,788	35,506	5,716	3,095	2,252	61,357

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	32,339	84,184
Penang ...	9,882	31,422
Port Swettenham.	5,866	14,622
Malacca ...	502	1,941
MALAYA ...	48,589	132119

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... } Straits Settlements }	39,773	106325
MALAYA ...	39,773	106325

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, the figure is an estimate based on the average found for the year 1930. Purchases by dealers S.S. from S.S. estates of less than 100 acres during the month amounted to 1,877 tons, and to 1,872 tons during February (not previously reported).

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with the omission of certain explanatory notes, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on April, 19, 1931.

GENERAL RICE SUMMARY.

March, 1931.

Malaya.—By the end of the month harvesting was practically complete in almost all the rice growing areas. In the Dindings and Perak harvesting was still in progress. Yield estimates will probably be published in the next issue of this journal.

The net imports of rice into Malaya (i.e. consumption of foreign rice) in March, 1931 was 47,008 tons.

Of the total imports of foreign rice Siam provided 52 per cent., Burma 42 per cent., French Indo-China 5 per cent. and other countries 1 per cent.

The total exports of rice from Malaya during March were 13,474 tons of which only 9 tons were locally produced.

India.—The total foreign exports (as reported by the *Indian Trade Journal)* during January, 1931 were 146,000 tons against an average in January for the last six years of 116,000 tons.

Java, Madura and N.E.I.—The position of the crops at the end of February, 1931 was substantially the same as that at the same date last year.

French Indo-China.—His Britanic Majesty's Consul-General at Saigon reports for the month of February, 1931, as follows:—

> "The latest reliable estimate puts the exportable surplus for 1931 at 1,200,000 metric tons.
>
> For the first two months of 1931 the amount exported only amounted to 113,442 tons as compared with 227,680 tons during the same period in 1930.
>
> An annual transaction took place at the end of the month when 1,000 tons of Siam rice was transhipped in Saigon for Madras."

The following notes and tables will be of interest.

Average wholesale Siam rice prices per ton in Singapore, were in dollars (Straits):—

	1930	1931			Increase (—) or decrease (—) % on previous month.
	Average Jan.-Dec.	January	February	March	
Singapore No. 1 ...	130	94	89	80	— 10.1
Singapore No. 2 (Special)...	118	85	80	70	— 12.5
Singapore No. 2 (Ordinary)	108	76	73	65	— 11.0
Siam White Broken A. 1...	86	58	51	48	— 5.9
Siam White Broken C. 1...	81	55	48	45	— 6.2

The stocks of rice as reported by Wholesale Dealers in Singapore, Penang and Malacca during the following periods were, in tons:—

1930				1931		
September	October	November	December	January	February	March
25,730	17,678	13,492	22,691	15,854	20,378	21,803

Net Imports of Rice into Malaya (Consumption of Foreign Rice) March, 1931 (in tons.)

Into	Tons	Percentage	Percentage 1930
Singapore ...	22,624	48	45
Penang ...	9,160	19	24
Malacca ...	4,246	9	3
F.M.S. ...	10,318	22	25
U.M.S. ...	660	2	3
Total ...	47,008	100	100

Average Declared Trade Values and Retail Market Prices.

Monthly	Retail Market prices in cents per Gantang of No. 2 Siam Rice					
	1930			1931		
	Singapore	Penang	Malacca	Singapore	Penang	Malacca
January	54	56	52	37	44	38
February	51	55	52	35	40	35
March	47	54	51	35	38	36

METEOROLOGICAL SUMMARY, MALAYA. MARCH, 1931.

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day Amt.	Number of days: Precipitation* .01 in or more	Precipitation, .04 in or more	Thunder-storm	Thunder heard	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent	Length of Day
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.							hr.	hr.	%	hr.
Railway Hill, Kuala Lumpur, Selangor ...	94.5	73.6	84.1	97	70	90	76	85.4	85.1	7.30	185.4	2.30	17	15	3	24	1		228.15	7.36	61	12.1
Bukit Jeram, Selangor ...	91.5	74.3	82.9	94	72	88	77	89.1	89.7	2.15	54.6	0.49	13	10	3	26	1		256.45	8.27	68	12.1
Sitiawan, Perak ...	91.8	73.9	82.9	95	70	88	77	86.0	85.2	2.30	58.4	0.57	10	10	7	24			250.40	8.08		
Kroh, Perak ...	93.3	69.4	81.3	95	64	91	73	84.8	83.7	2.40	61.0	0.84	7	5		5	2		284.60	9.18		
Temerloh, Pahang ...	93.3	73.5	83.4	96	68	88	76	87.9	86.5	2.65	67.3	1.21	10	8	1	11	7		249.85	8.06	67	12.1
Kuala Lipis, Pahang ...	93.0	72.3	82.7	95	67	89	76	85.3	84.8	4.42	112.3	1.45	9	7	3	10	11	2	257.40	8.30	70	12.1
Kuala Pahang, Pahang ...	87.7	75.5	81.6	92	72	81	83	87.3	86.0	3.96	100.6	1.32	12	7	2	3			269.40	8.69	72	12.1
Mount Faber, Singapore ...	89.9	74.7	82.3	94	73	84	77	81.9	82.4	5.18	131.6	1.23	17	12	3	16			196.00	6.32	52	12.1
Butterworth, Province Wellesley ...	91.2	75.4	83.3	95	72	88	78	87.6	85.9	1.47	37.3	0.74	7	4	1	15		1	290.10	9.36		
Bukit China, Malacca ...	89.2	74.8	82.0	95	72	84	77	85.8	85.9	6.68	169.7	2.39	14	12	7	14			241.25	7.78	64	12.1
Kluang, Johore ...	91.7	72.8	82.3	95	69	84	76	83.5	83.0	4.94	125.5	1.12	14	11	1	17	6		207.85	6.70	55	12.1
Bukit Lalang, Mersing, Johore	86.3	72.9	79.6	89	68	82	80	82.1	81.7	6.84	173.7	1.80	12	9		1	2		264.75	8.54	71	12.1
Alor Star, Kedah ...	95.5	72.2	83.9	99	66	90	75	86.6	86.3	1.45	36.8	0.49	8	3	1	12			293.20	9.46	78	12.1
Kotal Bahru, Kelantan ...	90.3	71.6	80.9	94	66	88	76	83.6	83.6	0.45	11.4	0.40	2	2		1			311.70	10.05	84	12.0
Kuala Trengganu, Trengganu	89.0	72.8	80.9	92	69	86	75	84.3	84.5	0.42	10.7	0.27	7	3			1		315.00	10.16	84	12.1
HILL STATIONS.																						
Cameron's Highlands, Rhododendron Hill, Pahang 5120 ft. ...	75.2	59.4	67.3	79	57	70	62			4.63	117.6	2.09	8	7		8	1		219.15	7.07	58	12.1
Cameron's Highlands, Tanah Rata, Pahang 4750 ft. ...	74.9	53.5	64.2	78	46	71	60	69.7	69.2	4.33	110.0	1.82	11	7		9			209.20	6.75	56	12.1
Fraser's Hill, Pahang 4268 ft.	76.0	63.0	69.5	80	60	73	65	73.5	73.3	7.57	192.3	1.85	14	13	2	11	17		221.05	7.13	59	12.1

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THE

Malayan Agricultural Journal.

JUNE. 1931.

EDITORIAL.

Cinchona.

The estimates of the late Sir Andrew Balfour that malaria causes the death of two million persons annually and that one-third of the human race suffers from this complaint are figures that have not been seriously refuted. The same authority states that an annual production of 26,000 tons of quinine would be necessary to treat all these patients.

Admittedly, as Dr. M. Kerbosch asserted in an address on Cinchona cultivation in Java, an abstract of which is included in this number, the above calculation has but a theoretical value. But it provides a basis for an endeavour towards the complete quininisation of malarial regions.

The above statements indicate the ideal situation, which admittedly is not yet within the region of practical politics, and the actual position, as the Java authority expresses it, is " the actual requirements demanded of an economical system of cultivation."

The present position is that 97 per cent. of the world's production of cinchona bark, from which quinine is extracted, is produced in Java. The total world production of bark is therefore about 12,000 tons per annum, which is approximately equal to 600 tons of quinine.

The Dutch contention is that the world is provided with all the quinine it is capable of purchasing at a price which allows a fair profit to the grower. This price is fixed by the Kinabureau, which is a Bureau constituted of 6 representatives of the cinchona planters and 6 representatives of the manufacturers. The Cinchona Agreement, the terms of which are decided by this Bureau and are revised from time to time, regulates the price of quinine to the world.

The author contends that this organisation has never exploited its monopolistic position and has, in fact, worked not only for the benefit of producers and manufacturers, but by reason of stabilising prices over a number of years, has prevented quinine becoming a speculative article in the hands of middlemen and has made it possible for governments to purchase quinine at a very low price for use in malarial areas. The Netherlands East Indies authorities resent, therefore, the suggestion frequently made, that the Dutch Cinchona Monopoly has used its powers to force up the price of a commodity of which practically the whole world requires supplies.

We think that Dr. Kerbosch has stated the case for the cinchona producers with great clarity and we gladly admit, not only that the Dutch are to be congratulated on the perseverance which has resulted in this outstanding success, but that the Cinchona Agreement has been of benefit by placing the cultivation of the crop on a sound basis and ensuring a steady supply of the product at a stable market price.

But in view of the international importance of this question of cinchona supply we have to ask ourselves whether the present position of control by the Kinabureau is adequate to meet the position at the present time.

If the Dutch view of the situation is correct that the present production supplies as much quinine as can meet the economic situation, and if the evidence placed before the League of Nations is also correct that 26,000 tons of quinine are required to supply the present malarial sufferers, it follows that the difference, namely, approximately 25,000 tons is required to supply those who cannot afford to purchase this medicine at a price which will allow an adequate profit to the growers. In terms of acreage this means that instead of the 55,000 acres which at present supplies the economic demand, approximately one million acres would be required to meet the "un-economic demand." We wish here to emphasise the fact that the difference between present production and possible consumption is so great that the whole question of supply and demand merits re-investigation.

There would appear to be one essential difference between the method of cultivation of cinchona in Java and that in India. In the former country the crop is grown over long periods on the same rich volcanic soils. In India the prunings and thinnings are used from about the fourth year, the crop being uprooted in about the tenth year. It is found that a second crop of cinchona cannot be grown on this land for a considerable number of years, in consequence of which it is necessary continually to be opening up new land. The Java system seems not only more economical, but more likely to make possible considerable extensions of the area for cultivation of the crop on a permanent basis.

It would seem that a careful survey is desirable of the areas suitable for the cultivation of cinchona. Such a survey cannot by its nature be the function of any one government, but might possibly be instituted by such a body as the League of Nations. With the information so obtained, the League would be in a position to recommend to various governments the quantity of cinchona required to be grown in order gradually to extend the treatment of malaria in areas that cannot be supplied on an economic basis. The governments concerned could thus arrange, either to subsidise the growers for the supply of this additional cinchona, or to establish government or international cinchona plantations for the purpose.

Opening of the School of Agriculture.

With the opening of the School of Agriculture, Malaya, an account of which is given in this issue, is inaugurated an institution which should fill a very definite position in Malayan agriculture. School gardening, which for some years has been included in the curriculum of Malay vernacular schools, is of value in teaching the rudiments of agricultural practice and inculcating a liking for rural pursuits, but it does not, and is not intended, to fit pupils to take their place in more ambitious agricultural spheres. Such an object can only be attained by the provision of a school of agriculture.

The new school provides two courses of instruction, viz : a one year course, mainly practical and a three years' course which is of a more technical nature and which should fit the successful students to fill various subordinate positions in the Departments of Agriculture and Co-operation, and the Rubber Research Institute of Malaya, and should enable them to accept more responsible posts on rubber estates and in the other practical agricultural activities of this country.

The fact that this School has commenced work during a period of widespread trade and agricultural depression may possibly be the cause of some misgiving amongst those who are unaware of the amount of thought and careful planning that has preceded the erection of the School. The advent of the slump, which particularly affects agriculture can, in our mind, only emphasise the necessity for agricultural education, to enable this country to be more adequately equipped to re-organise its agricultural activities in conformity with new economic factors. The country which successfully surmounts these difficulties is that which possesses the means of rapidly adapting its agricultural methods to a new set of conditions, which cannot be considered of a temporary nature, for as far as our major agricultural industries are concerned, it is unlikely that prices will revert to the old levels—at least for a considerable time.

We have mentioned that this project is the result of considerable thought and careful planning. The history of these deliberations goes back seventeen years. In 1914 a committee was appointed by Government consisting of four officials and three un-officials to consider the question of the establishment of a College of Tropical Agriculture. The findings of this committee are of interest. They were, *inter alia,* that the school should be one for the training of Asiatics. It was held that the institution should be in the nature of a school of agriculture, and under the control of the Director of Agriculture. The report of this meeting also states :—" It was further decided to invite attention to the urgency for the establishment of this school." On account of the Great War, the scheme was held in abeyance until 1920.

In the meantime, Dr. R. O. Winstedt, afterwards Director of Education, S.S. & F.M.S. visited Java in 1916 and provided Government with detailed information on the subject of agricultural education in that country.

Early in 1921, Mr. D. H. Grist, at that time Agricultural Instructor of this Department, reported on the system of agricultural education obtaining in Ceylon

and added proposals for agricultural education in Malaya. The Government supported these proposals, but the project was again held up on account of the "Slump" which followed in the next year or so. With the advent of more prosperous times in this country, the proposals were again taken up in 1926. Since then a Committee has worked on the details of the scheme, considered plans for the necessary buildings and more clearly defined the curriculum.

The opening of the school is therefore the fruit of the experience of many officials and un-officials in this country and in other countries. Much valuable experience has been gained at the small school of agriculture which was established at the Department of Agriculture in 1922 for the training of the Malay officers of the Department.

In spite of the present depression in industries, the School of Agriculture, Malaya is inaugurated under favourable conditions, and we expect it to have an ever extending beneficial influence on the progress of agriculture in Malaya.

The Malayan Exhibition.

The Malayan Agri-Horticultural Association, having emerged from a crisis in its history, has decided to hold its eighth annual Malayan Exhibition at Kuala Lumpur during the August Bank holidays. This is a decision that we welcome, for we believe that this annual event is capable of much useful work in encouraging native agriculture. In addition, it provides a unique opportunity for this Department, as well as for such bodies as the Rubber Research Institute and the Committee for Public Health Education, to demonstrate the application of new results of scientific research. These institutions have not been slow in the past in taking full advantage of the opportunities offered by the Malayan Exhibition, and it is noticeable that their demonstrations have annually increased in scope and improved in method of presentation.

It may be argued that it is unwise to hold the Exhibition during the present period of trade depression. On the other hand, the Exhibition may assist in stimulating trade and should encourage extended and better cultivation of foodstuffs by small-holders.

But the Exhibition has a still wider utility. It invites the reasoning public to review annually the position of Malaya as regards her foreign trade and the security of her internal economy. The fact is becoming increasingly evident that while the strength of the country lies in her normally valuable exports, the weakness of the position is the almost entire dependence on imports of staple foodstuffs. The dependence of Malaya on imports of rice, tea, meat and dairy produce is too well known to need reiteration in this place. It is the policy of the Department of Agriculture to demonstrate at the Exhibition means whereby Malaya may become more self-supporting in these respects and we venture to predict that our contribution to this subject at the forthcoming Malayan Exhibition will indicate new avenues for enterprise and progress towards the attainment of this object.

Original Articles.

CARDAMOMS*

BY

E. A. CURTLER,

Assistant Agriculturist.

This spice plant has been cultivated in India and Ceylon for many years, and considerable quantities exported annually especially to other Eastern countries. In view of the development of the Highlands of Malaya, which may prove a suitable situation for the cultivation of this crop, the following account is of interest.

Cardamoms are grown on the hills in both South India and Ceylon, although the chief centre of production is on the Cardamom Hills of South India, which thus gives their name to the crop. Cardamoms appear to thrive better in the former country than in Ceylon. On European-managed estates they are usually planted as a subsidiary crop to tea and coffee on comparatively small areas.

Cardamoms may be planted at elevations between 2,000 and 6,000 feet above sea-level but most of the cultivated areas lie between 2,000 and 4,000 feet. They require a fairly well distributed rainfall of between 125 and 150 inches per annum.

Situation.

One rubber cum tea estate in Ceylon has 47 acres of cardamoms, which are planted on the two sides and at the end of a deep valley, at an elevation of 3,800 feet. The average rainfall for the last 17 years has been 133 inches per annum and the average number of wet days 211.

Cardamoms are planted in sheltered situations in valleys where there is good soil. It is essential that the soil should be fairly moist and retentive of water, but on the other hand, drainage must be resorted to if the soil tends to become the least water-logged. As, however, the sides of the valleys are usually fairly steep, drainage is seldom necessary. In some places in Ceylon the soil is an exceptionally good chocolate-coloured loam, but in others it is less suitable as it contains a large quantity of gravelly quartzite similar to the South Indian soils. The type of soil is clearly reflected in the growth of the cardamoms.

In selecting a site for a plantation of cardamoms it is imperative that it should be one that is growing good jungle and at the same time be well sheltered from the wind.

Shade.

When felling the jungle, only the bushy undergrowth is removed and possibly a few of the smaller trees if they are very numerous, but nothing over 12 inches

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*** The following is part of the Author's report on an official tour of six months in Ceylon and India undertaken in 1930.**

diameter should be cut. The shade left should be fairly dense, but at the same time the canopy of leaves should not be so thick that no light can penetrate. This shade not only improves the growth of the crop, but also checks the development of weeds. This could be clearly seen under fairly dense shade where there was scarcely a weed, while on somewhat poorer soil with thinner top shade there was almost a complete carpet of weeds.

Another result of shade is to prevent soil erosion, for where the shade is fairly dense there is an exceptionally fine layer of humus in the soil, despite the steep slope of the field. This is doubtless, in some measure, due to the fact that the large leaves of the cardamoms break the force of the rain and only allow it to fall to the ground as a spray or to run down the leaf stems into the stool of the plant. Further, is must be appreciated that the jungle trees left for shade must, to some extent, reduce the beating force of the rain.

Planting.

The usual method of planting cardamoms is to hole the area as soon as possible after the undergrowth has been cleared. The planting distance is usually 8 feet by 8 feet or possibly less, down to 6 feet by 6 feet. The holes are dug 2 feet by 2 feet and about 15 inches deep. A few pounds weight of cattle manure are placed into each hole and the latter is then filled with good surface soil, the soil and the manure being thoroughly mixed. The most common method of propagation is to take up the whole stool of a mature plant and carefully divide it, at least two tubers being planted in each hole.

It is also possible to propagate cardamoms by means of seed, but no information was obtainable on this point.

The Mysore variety is characterised by the long fruits with leaves that are silky on the underside. It is probable that this is the chief variety cultivated, but there is considerable confusion regarding the varieties, and there are a number of apparent hybrids.

In South India it is usual to replant an area after about twenty years, fresh holes being dug in the centre of each square and planted with tubers obtained by dividing the best stools of the growing crop. In Ceylon the plants are cropped for as long as forty years without replanting. This possibly accounts for the much smaller crops obtained there than in South India.

If the shade is satisfactory it is only necessary to weed the crop once a year. In addition, the coolies pull out any big weeds when harvesting. Weeding is usually done during the months of July and August when there is only a small crop maturing, but this is liable to alteration where the labour is required for another crop growing on the estate. The weeding, as with tea, is done with a small scraper of hoop-iron or a small chisel; "changkols" are strictly forbidden as it is considered that they disturb too much soil, resulting in an undue amount of erosion. A second weeding and general clearing up may take place during February—March if labour is available.

Pruning.

Pruning is usually carried out while the July weeding is in progress. It consists of cutting back all stems that have commenced to die, to about 2 feet above the ground. Care must be taken that the stems are not cut back too far as the natural die-back of the stems is very liable to spread down into the tubers at the base; should this happen, it will sometimes spread through the tubers and eventually kill the whole stool. The stems removed are those which are turning yellow and brown and which have had racemes growing at their bases. The dead racemes are also cut right back and removed from the stool. Any dead leaves, either from the cardamoms or from the shade trees, are removed from the hollow inside the stool and earth is scraped up round the base of the stems and over the tubers.

The best sign of a flourishing crop is a good number of new shoots, as each of these shoots produces a flowering raceme from its base. The stools of the mature plants reach as much as 5 feet in diameter in good soil, but are only about three feet across in the more exposed places with quartzite soil. Various attempts have been made to stimulate the crop by the application of manures, but it has not been found satisfactory and no marked increase of crop has ever been obtained by manuring. The reason given for this failure to respond to manure is the fact that cardamoms are naturally very deep-rooted and have very few, if any, roots near the surface of the soil; neither do the roots tend to spread out much from the sides of the plant.

Harvesting.

The flower on the receme remains open for about a week, a further three months elapsing before the fruits are ripe. In South India the fruit ripens during the period September to December and occasionally the harvest will extend into January, but in Ceylon the main crop is harvested from September to December, while there is in some years a secondary harvest during March and April, and invariably a certain amount of fruit ripening throughout the year.

When the main crop is ripening, it is necessary to send the harvesting gang round once every three weeks, but in the off season the interval may be increased to as much as six weeks. The incidence of the crop depends very largely on the rainfall; frequent heavy showers encourage the flowers to open, but if the rain continues after the flowers are open it reduces the number of flowers which set fruit.

One of the chief difficulties with cardamom cultivation is to maintain a sufficient force of efficient pickers, as it is very difficult to train the average Tamil woman for the work. The need for care arises from the fact that on the same raceme there may be fruits in all stages of ripeness, together with flowers. It is not desirable to allow the fruits to remain on the racemes till they are a deep yellow colour as much of the crop will be lost by falling naturally. The

fruits require to be collected as soon as the seeds become black, by which time part of the glutinous matter in the fruit will have dried up. Any fruit in which the seeds have not turned black is considered unripe. At this stage there is no very marked difference in the colour of the fruits, but a well-trained woman can tell whether it is ripe by the amount of pressure that has to be exerted on the fruit to make it fall from the raceme. It is customary to allow the women to harvest between 10 and 20 per cent. of unripe fruits without penalty.

The plants bear a small crop during the third year, which gradually increases to the eighth or ninth year and then remains about constant till the fifteenth year when it begins to decrease. In India and on some estates in Ceylon, re-planting is carried out about the twentieth year.

The average annual crop from mature plants in India is 1 cwt. per acre, the variation being between 80 and 120 lbs. From plants in Ceylon, reported to be forty years old, the average crop is 70 lbs. per acre, varying between 40 and 90 lbs. It is said that in some of the old estates the yields have fallen to as low as 20 lbs. per acre. A woman will harvest about a quarter of an acre a day and is paid at the rate of approximately 3 cents (Straits) per pound of fresh fruit.

Diseases and Pests.

The crop is practically free from either diseases or pests. Two minor pests have been recorded, but neither have ever reached sufficient proportions to call for detailed investigations into methods of control.

A borer *Dichorocis punctiferallis* Gn., is found in both South India and Ceylon. It attacks the tubers of the plant just below the collar and causes the stem to become slightly yellow. The amount of damage done is usually insignificant. Another borer, *Lampides elpis* Godt, very occasionally attacks the fruits.

It is, however, necessary to keep a watchman constantly employed in a cardamom field in order to shoot and drive away monkeys, pigs and porcupines. Further, if there is a village in the vicinity, or if there is easy access from a road, steps have to be taken to check theft which is particularly troublesome, as the thief invariably strips the racemes of all the fruit, both ripe and unripe, and so reduces the crop over a long period.

Preparation for Market.

There are two methods of preparing the fruits for the market, namely, "Sulphur-Bleaching" and "Green-Drying." The latter is by far the simpler method and is generally practised, particularly in India, but at times the premium paid on the sulphur-bleached product is high enough to encourage the former and more complicated method of preparation.

Sulphur-Bleaching. As soon as the fruits are brought in from the field they are carefully washed in water to remove all dirt, leaves, stones, etc. For

washing, it is necessary to have a smooth-sided wooden or cement concrete tank, conveniently situated near the bleaching and drying sheds. As soon as the fruits have been washed and while they are still wet, they are spread in thin layers on the shelves of the sulphur box.

The sulphur box is constructed of mud and wattle spread over a wooden frame of sufficient size to treat the crop expected. In the box are wire-netting shelves about 5 inches apart, the mesh being just small enough to hold the fruits, and the door being so constructed that it can be hermetically sealed with mud. Approximately three cubic feet of space in the box are required for each five acres under the crop. As soon as the fruits have been spread, rock sulphur is ignited at the bottom of the box at the rate of half a pound for every 100 lbs. of fruit and the box is then sealed for 12 hours. Normally, the fruits when they are brought in from the field in the afternoon, are washed and left to bleach in the sulphur box overnight. The following morning they are spread in the open in single layers, regardless of weather, and frequently turned, otherwise the fruits will not bleach to an even colour. This airing is continued for a whole day. If the weather is wet, after one day in the open they may be spread in a drying room. The drying room is constructed of mud and wattle with a close-fitting door to render it as heat proof as possible.

Hot air is passed through the room, by means of an iron pipe about 9 inches in diameter extended along the floor on three sides of the room about a foot from the wall and supplied with hot air from a small wood-burning furnace.

If it is necessary to use the drying room, the fruits may be thoroughly dried in 1½ days, but as with sun-drying, they must be thoroughly dried. The fruits are kept till there is a period of settled fine weather. At some convenient time during storage, any remaining portions of the peduncle, which originally connected the fruit to the raceme, should be cut off close to the fruit with a pair of scissors. These portions of stem must be cut off as closely as possible, but care must be taken that the fruit itself is not damaged, otherwise it will be unsuitable for the No. 1 grade. In this connection, it is essential while harvesting to avoid including an unduly large number of stalks in the crop; a good harvester will pick the fruit without any of the peduncle.

With the advent of settled weather, the fruits are soaked in water for 12 hours in the washing tub. For this part of the process it is essential that the sides of the tank be smooth, as the fruits are liable to injury and if damaged must be relegated to an inferior grade. At the conclusion of the 12 hours soaking, the fruits are replaced in the sulphur box for a second over-night bleaching for 12 hours. The fruits are then re-dried for at least one day in the open, being turned frequently, and then for a further period of one or two days with occasional turning till thoroughly dry; on the latter days the drying room may be used if the weather changes, but this is not desirable.

This process of soaking, bleaching and drying is repeated a third time. Sometimes, if the fruit is thin or of a poor colour, it may be necessary to give a

fourth bleaching, but this is not usual. The yield is about 25 per cent. of bleached to fresh green fruit.

Green-Drying. This method is very simple when compared with the system of bleaching with sulphur. The fruit is washed till it is thoroughly clean and then laid out in single layers, on "tats" in the dark till it is absolutely dry. With the method of green-drying, the yield of saleable fruits will probably be about 30 per cent. of the fresh fruit.

Grading and Packing.

The first grading is made by eye, according to colour, any of the product showing signs of discolouration being put aside as "Brown." The balance is then further divided into whole and split fruits, the former being the perfect fruits while the latter are those which have been damaged, either when the the stumps of the peduncles are being trimmed or on other occasions during the preparation of the fruits. Each of the three grades is then further divided by being passed over a sieve to pick out the Nos. 1 and 2, which are the larger grades. The only other grade is "Seeds;" this consists of the seeds taken from those fruits which have become badly split or broken in the course of preparation. Although the seed is the commercial product it does not command a sufficiently high price on the market to justify the cleaning of all the fruits. Bleached cardamoms lose up to 4 per cent. of their weight in transit to London.

The fruits are packed in tea chests (100 lbs. size) or boxes, but a special waterproof paper is used in place of lead for lining the cases. The product is sold either in Colombo or London.

Exports from Ceylon.

(These are not annual crops as stocks are carried.)

Year.	Total Lbs.	U. K. Lbs.	Europe (balance) Lbs.	U. S. A. Lbs.	India Lbs.	Other Countries Lbs.
1927	339,148	121,805	140,000*	19,031	3,000*	55,312
1928	365,148	109,027	140,000*	62,837	14,000*	39,284
1929	303,982	77,698	133,000*	32,370	5,000*	55,914

* Approximate.

Approximate Prices in Colombo.

(Rupees and cents per lb.)

Year.	Bleached.			Green			Seed		
	High	Low	Average	High	Low	Average	High	Low	Average
1928	3.80	2.00	2.50	2.80	1.75	2.30	3.50	2.00	3.00
1929	2.75	1.85	2.30	2.20	1.50	1.90	Not recorded		

COCONUTS ON HEAVY SOILS *

BY

W. N. C. BELGRAVE,

Plant Physiologist.

This short paper is a confession of ignorance, and is written in the hope that by pointing out some of the more important points on which information is urgently needed Field Officers may be moved to give their own experiences and views.

In most of the other countries where coconuts are grown on a large scale, e.g. South India, Ceylon or the Philippines, the average soil is, judging from literature, lighter than ours. With a few unimportant exceptions the commercial growing of coconuts in Malaya is limited to 'heavy' soils. It is true that considerable areas have been laid down on deep peat, but judging from a recent article by the Assistant Chemist for Copra Research [1], prospects on such areas are not brilliant.

The soils proper may be divided into 'peaty'—loss on ignition exceeding 80 per cent., 'organic'—loss between 20 and 80 per cent. and clays (or silts), the terms referring to surface layers varying in depth from a few inches to 4 feet; nearly all have the same sub-soil type beneath viz., a blue grey very sticky clay. Soils and subsoils are in general richer in plant food than the usual inland soil.

Sampson in his book 'The Coconut' is quite definite about the unsuitability of heavy soils as the following extracts show—

"The essentials for natural drainage, therefore, are a free working soil of open texture, and either a deep water table or else free water movement through the soil. Too often, in newly opened-up countries, has the coconut had to take a back seat and give preference to rubber, which has been given the pick of the best-drained land, while any low-lying land which is not considered good enough for rubber has been relegated to the coconut. The result is that in those countries the possibilities of the coconut as a revenue producing crop have very rarely been realised.

"The natural drainage of the soil is, therefore, the first desideratum in choosing a site for a plantation. An examiniation of the natural vegetation on the land will often afford a useful guide to this. In open country, the presence of rushes, sedges and other water-loving plants will indicate poor natural drainage. Where there is forest growth the same method holds good, but it must not be forgotten that a dense forest growth makes great demands on the water in the soil, and that, though the land may appear to be fairly dry when

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* Paper read at the Second Inter-Departmental Agricultural Conference, Kuala Lumpur, F.M.S. October, 1930.

1 "Coconuts on Peat." F. C. Cooke, *Malayan Agricultural Journal,* Vol. XVIII, 12, 1930.

covered with forest growth, when the trees have been removed the drainage may be far from what is desired. The writer remembers seeing a native clearing on low-lying land near the coast where most of the forest trees had been removed. Those trees which had been left were all dying for no other apparent reason than that they were unable to withstand the excess of water in the soil after the main part of the forest had been cleared.

"In forest land where drainage is deficient one must also look out for the excessive formation of humus or organic matter. On such land this will often accumulate and cause the formation of what resembles peat. Usually where this occurs there will be found underneath an impermeable layer of stiff clay. An examination of any water courses in the neighbourhood will often form a guide to the nature of the sub-soil.

"A free working soil of considerable depth and with good drainage, even though of poor average fertility, is much more desirable than a rich soil which has not got free drainage, either being too heavy or with too high a water table. It may take longer to bring the trees to bearing, but the future prosperity of the plantation is assured when once it does commence to bear. The root system of the coconut has a very wide feeding range, and with good drainage will go to considerable depths. With trees planted 30 feet apart, there are fifty six to the acre. Thus each tree has on an average 777 cubic feet of soil for the roots to range in for each foot depth of soil. Thus where the roots can go down to say 8 feet, the tree has four times the quantity of soil which one has which can send its roots down only 2 feet."

It is interesting to note that Sampson[2] gives an instance in British Guiana of mature palms growing on heavy pagasse soils (apparently closely akin in character and mode of formation to our 'organic' soils) giving very heavy yields. He considers however that they cannot possibly have a long life.

In spite of this opinion we have a considerable number of estates over 16 years old which are still quite definitely commercial propositions averaging 11 piculs of copra and in some cases rising to 14—16 piculs.

It is suggested that Sampson has omitted from consideration the possibility of artificial drainage and that in this lies the key to the inapplicability of his remarks taken without qualification to Malaya.

Coconuts do not grow equally well on all of our types of soil; in addition to the areas of peat visited by Mr. Cooke there is another large area of dwarfs on deep peat which also shows little promise.

Coconuts growing on peaty or organic soils vary considerably in yield and appearance, depending to some extent on the surface soil. If this after drainage is one foot or less, excellent and continued growth is possible. From 1 foot to 3 feet (roughly) the plants seem in their early stages to grow remarkably but later they frequently lose ground and later still may become almost or entirely unremunerative. I have had no experience with deeper organic soils. Heavy soils with not more than 1—2 inches of 'humus' seem to support growth quite

2 Empire Marketing Board 4, 1927.

well except in the case of the extremely stiff soils found in patches in the neighbourhood of the Bernam river on which growth may be retarded.

It will be seen therefore that even with careful and extensive drainage Sampson's remarks, although far too sweeping, have some foundation.

We have now to enquire whether any explanation can be found for poor growth where it occurs. It must be stated at once that as is the case with nearly all coconut problems, no explanation is yet forthcoming. Since poor growth is frequently associated with peat or peat-like bodies the first object of research should clearly be acidity. Acidity, measured in suspension, of practically all peat, peaty or organic soils in this country is very high (pH2.8-4.4), clear extracts may however vary from pH 3.0 to the usual 6.4. Good mature coconuts are found on very acid (suspension) soils but there seems to be a rather direct connection between poor yield and growth and high acidity in clear extracts. As so often happens, it is impossible to state whether the effect is direct or whether both soluble acidity and poor yield are effects of poor drainage, aeration, etc. It is significant in this connection that in some cases where acidity is high the young coconuts make quite good growth and yet it is precisely in the early stages that acidity might be expected to show a maximum effect. In any event poor growth has been met with where drainage was excellent and soluble acidity practically absent.

Another line of attack is that of water supply, it may be that organic soils readily tend to dry down to near wilting point and here Britten Jones'[3] work on Bronze Wilt is of interest. In Trinidad coconuts planted on the old stiff sugar lands suffer considerably from 'wilt' and this is considered by Britten Jones to be due to excessively close drainage. It is also claimed that the wilt can be produced by severing the roots. A further fact in support of this theory is that on an area of particularly poor and dying coconuts in Selangor the trouble has been correlated with the fact that the organic soil (about 2 feet deep) overlies a sandy sub-soil, probably an old river bed. On the other hand, it is difficult to believe that our climate is likely to give rise to drought damage in normal years.

Walker in *Phil. Jour. Sc.* 1, page 60, 1906 points out the superior growth of trees near the sea-shore growing on very permeable soils, over those further inland on stiff clays and attributes this to the fact that the soils near the sea-shore are permeated by moving water while those inland, owing to their high water capacity, may be physiologically dry. He suggests the necessity of artificial irrigation for such heavy soils.

It is possible that soil atmosphere (which will shortly be investigated) may supply an explanation. Is it that oxidation of organic matter gives rise to an excess of carbon dioxide and deficiency of oxygen which adversely affects the roots as they tend to go deeper? It is impossible to decide between these alternatives without much further work and observation.

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3 Tropical Agriculture, 1928.

Another evil effect of poor aeration is the high probability that large quantities of toxic soluble ferrous (iron) compounds may be produced.

Where clays or silt come near the surface good growth can be maintained—the chief trouble met with is excessive leaning and eventual loss of trees in somewhat alarming numbers where the water table is high—due without doubt to the comparative shallowness of the root system and to the buttery consistency of the soil. Two remedies have been proposed (a) planting in deep holes, unless special precautions are taken this is likely to lead to trouble with water-logging, (b) deepening the drainage system and spreading the resultant spoil to give more root-hold.

As the trees seldom lean in any one direction it appears not impossible that some system of stays from tree to tree could be devised.

To sum up, organic and peat soils of more than 1 foot depth may lead to trouble in later stages of growth; with less than that depth excellent and long continued growth can be obtained under Malayan conditions, where some form of drainage is always provided.

The reason why certain soils in the neighbourhood of the Bernam should be excessively stiff has not yet been answered, pH, bases, mechanical composition and silica sesquioxide ratio are very similar to other less troublesome soils. The matter is being investigated in the Soil Laboratory and speculation at the present time would be unprofitable.

Drainage.

Here we touch the most controversial of topics. There are only two agreed points—

(a) that some form of drainage is necessary,
(b) that surface standing water is exceedingly deleterious, the leaves turning yellow and exhibiting the characteristic signs of nitrogen starvation.

When we come to the question of depth and interval of drains coconut planters seldom agree even when they are on adjacent or even on the same estates.

It need hardly be pointed out to an audience of experts that drainage is supposed to benefit the plant at least as much by the entrance of fresh air as by the removal of free water. At first sight it seems strange that there can be any drainage at all in our apparently extremely stiff soils or sub-soils but the fact remains that the free water-table *is* lowered by drains 1—2 chains apart and no one who has seen water pouring into recently deepened drains can ever doubt that movement does take place; further, borings show quite clearly that the water table at any time is nearly uniform. Yet such soils or sub-soils may show practically no coarse fractions at all; with a similar mechanical analysis in temperate climates they would require sub-soil drains every few feet. The greatest difference lies in the chemical composition of the 'clay'

which with us is lateritic in nature and therefore not nearly so 'sticky as is 'clay' in a temperate climate. I have made observations on the percolation of water through some of our heavy clays and find that a layer of soil 4 inches deep can under a head of 8 inches pass approximately 1 mm. of water per day. This would be sufficient to ensure adequate lowering of a water table. Owing to the very high water capacity of these heavy soils and sub-soils, amounting to 90 per cent. on dry weight, it is not certain that air movement is greatly facilitated and this is probably responsible for the fact that the bulk of roots are found at depths of less than 15 inches.

Water Movement.

All writers on the subject emphasise the fact that a high water table is not necessarily injurious provided there is free *movement* of water and Howlett has recorded some interesting observations on this point on light soils on the East Coast. One very successful estate in the North makes use of sub-soil irrigation by keeping a ditch at the higher end of the field full of water, with a deep drain at the other. On the majority of estates however such movement is not easy to obtain and it might be worth investigation whether, say, weekly alterations of level by means of water-gates would be beneficial.

Observations by Agricultural Field Officers are particularly called for in connection with drainage as experimental interference with levels is difficult and owing to the unknown length of time required for root systems to accommodate themselves, results may be misleading.

The question of salt is connected with drainage. While the presence of salt does *not* explain the majority of cases of poor growth (it is always sought), Cooke has recorded observations which indicate that brackish water near the sea does not support good growth.

Cultivation and Cover Crops.

Here again we are confronted with conflicting opinions, ranging from the clean weeding enthusiast to the let-the-grass-grow-and-slash-it-sometimes planter. Deep cultivation is little practised and on most shallow-rooted areas would undoubtedly result in an initial decrease of yield. Only experiment can decide between the different systems on any given type of soil.

Manuring.

There is little manuring in Malaya in striking contrast to Ceylon where manures are normally employed. Our heavy soils should, in theory, contain sufficient plant food and the possibility of dispensing with manures should compensate for extra expenditure on drainage—but there is always the possibility that a small amount of stimulant may be beneficial.

There remains the question of the return of nutrients in leaves and husks to the soil. I am convinced that where débris is left to rot on a clean weeded surface of heavy soil very large losses of nutrient occur in run-off water.

Where the husks are burnt and the ashes returned nitrogen is of course lost.

Analyses from different sources of the nutrients contained in crop products differ materially and the following figures are given merely as indications—they are from the Philippines, converted into lbs. per acre with a crop of 2800 nuts.—

	Nitrogen (N)	Potash (K_2O)	Phosphorus (P_2O_5)
Husk and Shell ...	14	32	4
Meat	31	16	11
Milk	10	8	1
	55	56	16
Leaves (dead) ...	27	68	21

It is clear that, even if these quantities are halved, there is considerable reason for work on conservation of residues and dead leaves. Officers' experience with estate practice will be welcomed.

Experiments in hand.

These may be summarised as follows—

Complete manure, with and without lime, is being tested on areas which are clean weeded and grass covered, and lightly and deeply cultivated—with the appropriate controls. The experiments are being laid down on different soil types and records will be made for a considerable period, this is particularly necessary owing to the length of maturation period of coconuts. Results of one large scale manurial experiment carried out over 5 years to which I have had access were completely negative and I am not optimistic of a more positive result with the new series—but a known and reliable negative result will be of utmost value.

There remains the question of liming. As stated above, many of the organic soils are highly acid; I hesitate, however, to suggest liming as a remedy, without further experiment. Firstly it is costly, secondly applications of even 1 ton per acre will not materially alter the pH and lastly acidity, as suggested above, may be more of an effect than a cause.

RICE MILLS IN MALAYA

BY

H. W. JACK,

Economic Botanist.

All the rice mills in this country are situated in or near the large rice producing districts of Kedah, Province Wellesley, Penang, and North Perak, and with the exception of two large Government mills, they are all in the hands of the Chinese.

In Kedah, there are 21 mills, but only 18 have been worked regularly. Of these there are 3 large mills and 15 of medium size the latter having capacities varying from 1,000 to 4,000 gantangs of padi per diem. The annual output varies considerably, but probably averages not less than 20 million gantangs of padi annually. The bulk of the output is polished white rice, though a little "parboiled" is also produced.

In Province Wellesley, there are 8 mills, of which only 6 are operating. One of these is a small mill, 4 are mills of medium capacity (3,000—4,500 gantangs padi per diem), and one is a large mill of some 22,000 gantangs of padi daily capacity.

The smaller mills usually obtain their entire padi supplies from local cultivators, but the larger mills not only purchase local padi but import supplies from Kedah, Perak, and Teluk Anson (grown in Kuala Selangor) and in some years even import padi from Burma and Siam. The total annual out-turn of the mills in Province Wellesley is about 6,500,000 gantangs of padi, of which approximately 80 per cent. is converted into parboiled rice for consumption by Indian labourers on estates.

There are 11 mills in Penang—6 situated in the south-west district and 5 in Georgetown. Of the former only 4 small mills driven by water power ("lesong ayer") are operating and mill in all some 48,000 gantangs of padi per annum in a good year, the padi being purchased from local cultivators and converted into white unpolished rice for resale to the growers and other Malays. Of the latter, only three are operating—one of medium capacity and two large mills. Each of these three mills is supplied with padi shipped from Kedah, Province Wellesley and Krian, and the out-turn amounts to some 900,000 gantangs of padi per annum. Approximately, 75 per cent. of the padi milled is converted into parboiled rice, the remainder being sold as polished rice.

In North Perak, there are 3 large rice mills, all situated in the Krian District. Two of these mills are owned by the Government—one being located at Bagan Serai and having a capacity of some 200 bags of rice per diem;* the other at Kuala Kurau is about four times as large but has not been worked since 1927 owing to lack of sufficient supplies of padi.

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* A bag of rice weighs approximately 227 lbs. (or 170 kati).

The third mill is Chinese owned, situated in Parit Buntar and has a capacity of 200 bags per diem of twelve hours. The Bagan Serai and Parit Buntar mills each produce 50,000—60,000 bags of rice per annum, of which probably 90 per cent. is parboiled. They depend for their supplies almost entirely on Krian grown padi though some padi is usually purchased in Kedah. It may be mentioned that the establishment of Government mills in the Krian District aimed at stabilising padi prices and the encouragement of padi planting by ensuring fair prices for padi locally grown.

In addition to the large mills in Krian, there are a few small power mills on adjacent estates for which Krian padi is purchased at prevailing rates, and these mills handle annually some 400,000 gantangs of padi.

In milling padi by the parboiling process, the products are generally estimated by weight as follows:—Rice 62 per cent., Broken rice 2.2 per cent., Bran 9.2 per cent., Husk 26.4 per cent.

When white rice (polished) is produced if the padi season has been a good one, the milling products show approximately the following proportions:—White rice 62 per cent., Broken rice 2.5 per cent., Bran 5.9 per cent., Cargo bran 6.5 per cent., Husk 23.1 per cent.

With the exception of the husk, which affords an efficient fuel for working the mills, all the above products command profitable prices.

Broken rice (white and parboiled) is used occasionally for human food, but generally for feeding pigs and fowls.

Polishings and bran are sold in two grades, and the following figures are the average prices during the last five years at Bagan Serai Mill:—

White Broken Rice	...	averaged	$7.85	per	bag	of	170	kati.
Parboiled Broken Rice	...	„	$6.68	„	„	„	170	„
White Polishings	...	„	$3.30	„	„	„	100	„
Parboiled Polishings	...	„	$2.81	„	„	„	100	„
White Cargo Bran	...	„	$1.41	„	„	„	75	„
Parboiled Cargo Bran	...	„	$1.28	„	„	„	75	„

Prices for by-products vary somewhat in the different mills, depending on supplies and demand.

None of the mills in Malaya are worked at full capacity, since padi supplies are usually much below requirements, though, in good padi seasons, some of the mills can obtain sufficient supplies to keep them going for 8—9 months. Also, padi and rice prices in Malaya are controlled by factors outside the country, and sometimes in consequence local padi milling is not profitable.

This summary of information on local mills is based on reports written by Field Officers in Perak North and in Province Wellesley and by the Principal Agricultural Officer, Kedah, whose assistance is acknowledged.

THE PREPARATION OF COIR FIBRE

BY

B. BUNTING,

Agriculturist.

Native Manufacture.

Opportunity was taken, during a visit to Ceylon in February, 1930, to investigate the coir fibre industry which has long been established in that Colony.

A visit was paid to a small coconut fibre mill, run by a Sinhalese, near Chilaw.

The extractors were locally-made and housed under an open shed made of kajangs.

The coconut husks usually cost about Rs. 3 per thousand delivered at the mill, but when the price of fibre is high as much as Rs. 4 per thousand is paid. The husks are retted in water for a period of 3 to 4 weeks, a large open pit being employed for this purpose.

After the retting is complete the wet husks are passed through the extractors which are in pairs, one machine, with rough spikes, being called the "breaker" and the other, with fine spikes, called the "finisher."

The "breaker" is composed of large wooden drums fitted with coarse iron spikes and the cooly merely presses one half of the husk against the drum, which is revolving at a high speed, and withdraws the main portion of the fibre from the husk. The latter is then reversed and the other half treated in the same way.

The "finisher" is placed alongside the "breaker" so that the partially cleaned fibre can be handed over to the cooly in charge of the finisher. This machine is very similar to the "breaker", except that the drum is set with finer teeth, and removes the balance of fibre from the outer portion of the husk.

The fibrous portion not passing through the machines, but left in the operator's hands, is known as "bristle" fibre. This is removed to an open shed containing a large concrete tank filled with water, where the fibre is washed by hand and sun-dried.

The balance of the fibre passing through the machines, known as "mattress" fibre, is then sun-dried and afterwards passed through a winnowing machine. This machine consists of a revolving screen, open at both ends and placed at a slight inclination to the horizontal.

This work is carried out on contract and the two men in charge of a pair of machines are paid 50 cents per cwt. of wet bristle fibre produced. This usually given about one-third of its weight of dry fibre.

The following is a list of the machines employed in the mill in question—

5 pairs Extractors (i.e., 5 breakers and 5 finishers).

1 Revolving Screen for cleaning mattress fibre.

fourth bleaching, but this is not usual. The yield is about 25 per cent. of bleached to fresh green fruit.

Green-Drying. This method is very simple when compared with the system of bleaching with sulphur. The fruit is washed till it is thoroughly clean and then laid out in single layers, on "tats" in the dark till it is absolutely dry. With the method of green-drying, the yield of saleable fruits will probably be about 30 per cent. of the fresh fruit.

Grading and Packing.

The first grading is made by eye, according to colour, any of the product showing signs of discolouration being put aside as "Brown." The balance is then further divided into whole and split fruits, the former being the perfect fruits while the latter are those which have been damaged, either when the the stumps of the peduncles are being trimmed or on other occasions during the preparation of the fruits. Each of the three grades is then further divided by being passed over a sieve to pick out the Nos. 1 and 2, which are the larger grades. The only other grade is "Seeds;" this consists of the seeds taken from those fruits which have become badly split or broken in the course of preparation. Although the seed is the commercial product it does not command a sufficiently high price on the market to justify the cleaning of all the fruits. Bleached cardamoms lose up to 4 per cent. of their weight in transit to London.

The fruits are packed in tea chests (100 lbs. size) or boxes, but a special waterproof paper is used in place of lead for lining the cases. The product is sold either in Colombo or London.

Exports from Ceylon.

(These are not annual crops as stocks are carried.)

Year.	Total Lbs.	U. K. Lbs.	Europe (balance) Lbs.	U. S. A. Lbs.	India Lbs.	Other Countries Lbs.
1927	339,148	121,805	140,000*	19,031	3,000*	55,312
1928	365,148	109,027	140,000*	62,837	14,000*	39,284
1929	303,982	77,698	133,000*	32,370	5,000*	55,914

* Approximate.

Approximate Prices in Colombo.

(Rupees and cents per lb.)

Year.	Bleached.			Green			Seed		
	High	Low	Average	High	Low	Average	High	Low	Average
1928	3.80	2.00	2.50	2.80	1.75	2.30	3.50	2.00	3.00
1929	2.75	1.85	2.30	2.20	1.50	1.90	Not recorded		

COCONUTS ON HEAVY SOILS *

BY

W. N. C. BELGRAVE,

Plant Physiologist.

This short paper is a confession of ignorance, and is written in the hope that by pointing out some of the more important points on which information is urgently needed Field Officers may be moved to give their own experiences and views.

In most of the other countries where coconuts are grown on a large scale, e.g. South India, Ceylon or the Philippines, the average soil is, judging from literature, lighter than ours. With a few unimportant exceptions the commercial growing of coconuts in Malaya is limited to 'heavy' soils. It is true that considerable areas have been laid down on deep peat, but judging from a recent article by the Assistant Chemist for Copra Research [1], prospects on such areas are not brilliant.

The soils proper may be divided into 'peaty'—loss on ignition exceeding 80 per cent., 'organic'—loss between 20 and 80 per cent. and clays (or silts), the terms referring to surface layers varying in depth from a few inches to 4 feet; nearly all have the same sub-soil type beneath viz., a blue grey very sticky clay. Soils and subsoils are in general richer in plant food than the usual inland soil.

Sampson in his book 'The Coconut' is quite definite about the unsuitability of heavy soils as the following extracts show—

"The essentials for natural drainage, therefore, are a free working soil of open texture, and either a deep water table or else free water movement through the soil. Too often, in newly opened-up countries, has the coconut had to take a back seat and give preference to rubber, which has been given the pick of the best-drained land, while any low-lying land which is not considered good enough for rubber has been relegated to the coconut. The result is that in those countries the possibilities of the coconut as a revenue producing crop have very rarely been realised.

"The natural drainage of the soil is, therefore, the first desideratum in choosing a site for a plantation. An examiniation of the natural vegetation on the land will often afford a useful guide to this. In open country, the presence of rushes, sedges and other water-loving plants will indicate poor natural drainage. Where there is forest growth the same method holds good, but it must not be forgotten that a dense forest growth makes great demands on the water in the soil, and that, though the land may appear to be fairly dry when

* Paper read at the Second Inter-Departmental Agricultural Conference, Kuala Lumpur, F.M.S. October, 1930.

1 "Coconuts on Peat." F. C. Cooke, *Malayan Agricultural Journal,* Vol. XVIII, 12, 1930.

covered with forest growth, when the trees have been removed the drainage may be far from what is desired. The writer remembers seeing a native clearing on low-lying land near the coast where most of the forest trees had been removed. Those trees which had been left were all dying for no other apparent reason than that they were unable to withstand the excess of water in the soil after the main part of the forest had been cleared.

"In forest land where drainage is deficient one must also look out for the excessive formation of humus or organic matter. On such land this will often accumulate and cause the formation of what resembles peat. Usually where this occurs there will be found underneath an impermeable layer of stiff clay. An examination of any water courses in the neighbourhood will often form a guide to the nature of the sub-soil.

"A free working soil of considerable depth and with good drainage, even though of poor average fertility, is much more desirable than a rich soil which has not got free drainage, either being too heavy or with too high a water table. It may take longer to bring the trees to bearing, but the future prosperity of the plantation is assured when once it does commence to bear. The root system of the coconut has a very wide feeding range, and with good drainage will go to considerable depths. With trees planted 30 feet apart, there are fifty six to the acre. Thus each tree has on an average 777 cubic feet of soil for the roots to range in for each foot depth of soil. Thus where the roots can go down to say 8 feet, the tree has four times the quantity of soil which one has which can send its roots down only 2 feet."

It is interesting to note that Sampson[2] gives an instance in British Guiana of mature palms growing on heavy pagasse soils (apparently closely akin in character and mode of formation to our 'organic' soils) giving very heavy yields. He considers however that they cannot possibly have a long life.

In spite of this opinion we have a considerable number of estates over 16 years old which are still quite definitely commercial propositions averaging 11 piculs of copra and in some cases rising to 14—16 piculs.

It is suggested that Sampson has omitted from consideration the possibility of artificial drainage and that in this lies the key to the inapplicability of his remarks taken without qualification to Malaya.

Coconuts do not grow equally well on all of our types of soil; in addition to the areas of peat visited by Mr. Cooke there is another large area of dwarfs on deep peat which also shows little promise.

Coconuts growing on peaty or organic soils vary considerably in yield and appearance, depending to some extent on the surface soil. If this after drainage is one foot or less, excellent and continued growth is possible. From 1 foot to 3 feet (roughly) the plants seem in their early stages to grow remarkably but later they frequently lose ground and later still may become almost or entirely unremunerative. I have had no experience with deeper organic soils. Heavy soils with not more than 1—2 inches of 'humus' seem to support growth quite

2 Empire Marketing Board 4, 1927,

well except in the case of the extremely stiff soils found in patches in the neighbourhood of the Bernam river on which growth may be retarded.

It will be seen therefore that even with careful and extensive drainage Sampson's remarks, although far too sweeping, have some foundation.

We have now to enquire whether any explanation can be found for poor growth where it occurs. It must be stated at once that as is the case with nearly all coconut problems, no explanation is yet forthcoming. Since poor growth is frequently associated with peat or peat-like bodies the first object of research should clearly be acidity. Acidity, measured in suspension, of practically all peat, peaty or organic soils in this country is very high (pH2.8-4.4), clear extracts may however vary from pH 3.0 to the usual 6.4. Good mature coconuts are found on very acid (suspension) soils but there seems to be a rather direct connection between poor yield and growth and high acidity in clear extracts. As so often happens, it is impossible to state whether the effect is direct or whether both soluble acidity and poor yield are effects of poor drainage, aeration, etc. It is significant in this connection that in some cases where acidity is high the young coconuts make quite good growth and yet it is precisely in the early stages that acidity might be expected to show a maximum effect. In any event poor growth has been met with where drainage was excellent and soluble acidity practically absent.

Another line of attack is that of water supply, it may be that organic soils readily tend to dry down to near wilting point and here Britten Jones'[3] work on Bronze Wilt is of interest. In Trinidad coconuts planted on the old stiff sugar lands suffer considerably from 'wilt' and this is considered by Britten Jones to be due to excessively close drainage. It is also claimed that the wilt can be produced by severing the roots. A further fact in support of this theory is that on an area of particularly poor and dying coconuts in Selangor the trouble has been correlated with the fact that the organic soil (about 2 feet deep) overlies a sandy sub-soil, probably an old river bed. On the other hand, it is difficult to believe that our climate is likely to give rise to drought damage in normal years.

Walker in *Phil. Jour. Sc.* 1, page 60, 1906 points out the superior growth of trees near the sea-shore growing on very permeable soils, over those further inland on stiff clays and attributes this to the fact that the soils near the sea-shore are permeated by moving water while those inland, owing to their high water capacity, may be physiologically dry. He suggests the necessity of artificial irrigation for such heavy soils.

It is possible that soil atmosphere (which will shortly be investigated) may supply an explanation. Is it that oxidation of organic matter gives rise to an excess of carbon dioxide and deficiency of oxygen which adversely affects the roots as they tend to go deeper? It is impossible to decide between these alternatives without much further work and observation.

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3 Tropical Agriculture, 1928.

Another evil effect of poor aeration is the high probability that large quantities of toxic soluble ferrous (iron) compounds may be produced.

Where clays or silt come near the surface good growth can be maintained—the chief trouble met with is excessive leaning and eventual loss of trees in somewhat alarming numbers where the water table is high—due without doubt to the comparative shallowness of the root system and to the buttery consistency of the soil. Two remedies have been proposed (a) planting in deep holes, unless special precautions are taken this is likely to lead to trouble with water-logging, (b) deepening the drainage system and spreading the resultant spoil to give more root-hold.

As the trees seldom lean in any one direction it appears not impossible that some system of stays from tree to tree could be devised.

To sum up, organic and peat soils of more than 1 foot depth may lead to trouble in later stages of growth; with less than that depth excellent and long continued growth can be obtained under Malayan conditions, where some form of drainage is always provided.

The reason why certain soils in the neighbourhood of the Bernam should be excessively stiff has not yet been answered, pH, bases, mechanical composition and silica sesquioxide ratio are very similar to other less troublesome soils. The matter is being investigated in the Soil Laboratory and speculation at the present time would be unprofitable.

Drainage.

Here we touch the most controversial of topics. There are only two agreed points—

(a) that some form of drainage is necessary,

(b) that surface standing water is exceedingly deleterious, the leaves turning yellow and exhibiting the characteristic signs of nitrogen starvation.

When we come to the question of depth and interval of drains coconut planters seldom agree even when they are on adjacent or even on the same estates.

It need hardly be pointed out to an audience of experts that drainage is supposed to benefit the plant at least as much by the entrance of fresh air as by the removal of free water. At first sight it seems strange that there can be any drainage at all in our apparently extremely stiff soils or sub-soils but the fact remains that the free water-table *is* lowered by drains 1—2 chains apart and no one who has seen water pouring into recently deepened drains can ever doubt that movement does take place; further, borings show quite clearly that the water table at any time is nearly uniform. Yet such soils or sub-soils may show practically no coarse fractions at all; with a similar mechanical analysis in temperate climates they would require sub-soil drains every few feet. The greatest difference lies in the chemical composition of the 'clay'

which with us is lateritic in nature and therefore not nearly so 'sticky as is 'clay' in a temperate climate. I have made observations on the percolation of water through some of our heavy clays and find that a layer of soil 4 inches deep can under a head of 8 inches pass approximately 1 mm. of water per day. This would be sufficient to ensure adequate lowering of a water table. Owing to the very high water capacity of these heavy soils and sub-soils, amounting to 90 per cent. on dry weight, it is not certain that air movement is greatly facilitated and this is probably responsible for the fact that the bulk of roots are found at depths of less than 15 inches.

Water Movement.

All writers on the subject emphasise the fact that a high water table is not necessarily injurious provided there is free *movement* of water and Howlett has recorded some interesting observations on this point on light soils on the East Coast. One very successful estate in the North makes use of sub-soil irrigation by keeping a ditch at the higher end of the field full of water, with a deep drain at the other. On the majority of estates however such movement is not easy to obtain and it might be worth investigation whether, say, weekly alterations of level by means of water-gates would be beneficial.

Observations by Agricultural Field Officers are particularly called for in connection with drainage as experimental interference with levels is difficult and owing to the unknown length of time required for root systems to accommodate themselves, results may be misleading.

The question of salt is connected with drainage. While the presence of salt does *not* explain the majority of cases of poor growth (it is always sought), Cooke has recorded observations which indicate that brackish water near the sea does not support good growth.

Cultivation and Cover Crops.

Here again we are confronted with conflicting opinions, ranging from the clean weeding enthusiast to the let-the-grass-grow-and-slash-it-sometimes planter. Deep cultivation is little practised and on most shallow-rooted areas would undoubtedly result in an initial decrease of yield. Only experiment can decide between the different systems on any given type of soil.

Manuring.

There is little manuring in Malaya in striking contrast to Ceylon where manures are normally employed. Our heavy soils should, in theory, contain sufficient plant food and the possibility of dispensing with manures should compensate for extra expenditure on drainage—but there is always the possibility that a small amount of stimulant may be beneficial.

There remains the question of the return of nutrients in leaves and husks to the soil. I am convinced that where débris is left to rot on a clean weeded surface of heavy soil very large losses of nutrient occur in run-off water.

Where the husks are burnt and the ashes returned nitrogen is of course lost.

Analyses from different sources of the nutrients contained in crop products differ materially and the following figures are given merely as indications—they are from the Philippines, converted into lbs. per acre with a crop of 2800 nuts.—

	Nitrogen (N)	Potash (K_2O)	Phosphorus (P_2O_5)
Husk and Shell ...	14	32	4
Meat	31	16	11
Milk	10	8	1
	55	56	16
Leaves (dead) ...	27	68	21

It is clear that, even if these quantities are halved, there is considerable reason for work on conservation of residues and dead leaves. Officers' experience with estate practice will be welcomed.

Experiments in hand.

These may be summarised as follows—

Complete manure, with and without lime, is being tested on areas which are clean weeded and grass covered, and lightly and deeply cultivated—with the appropriate controls. The experiments are being laid down on different soil types and records will be made for a considerable period, this is particularly necessary owing to the length of maturation period of coconuts. Results of one large scale manurial experiment carried out over 5 years to which I have had access were completely negative and I am not optimistic of a more positive result with the new series—but a known and reliable negative result will be of utmost value.

There remains the question of liming. As stated above, many of the organic soils are highly acid; I hesitate, however, to suggest liming as a remedy, without further experiment. Firstly it is costly, secondly applications of even 1 ton per acre will not materially alter the pH and lastly acidity, as suggested above, may be more of an effect than a cause.

RICE MILLS IN MALAYA

BY

H. W. Jack,

Economic Botanist.

All the rice mills in this country are situated in or near the large rice producing districts of Kedah, Province Wellesley, Penang, and North Perak, and with the exception of two large Government mills, they are all in the hands of the Chinese.

In Kedah, there are 21 mills, but only 18 have been worked regularly. Of these there are 3 large mills and 15 of medium size the latter having capacities varying from 1,000 to 4,000 gantangs of padi per diem. The annual output varies considerably, but probably averages not less than 20 million gantangs of padi annually. The bulk of the output is polished white rice, though a little "parboiled" is also produced.

In Province Wellesley, there are 8 mills, of which only 6 are operating. One of these is a small mill, 4 are mills of medium capacity (3,000—4,500 gantangs padi per diem), and one is a large mill of some 22,000 gantangs of padi daily capacity.

The smaller mills usually obtain their entire padi supplies from local cultivators, but the larger mills not only purchase local padi but import supplies from Kedah, Perak, and Teluk Anson (grown in Kuala Selangor) and in some years even import padi from Burma and Siam. The total annual out-turn of the mills in Province Wellesley is about 6,500,000 gantangs of padi, of which approximately 80 per cent. is converted into parboiled rice for consumption by Indian labourers on estates.

There are 11 mills in Penang—6 situated in the south-west district and 5 in Georgetown. Of the former only 4 small mills driven by water power ("lesong ayer") are operating and mill in all some 48,000 gantangs of padi per annum in a good year, the padi being purchased from local cultivators and converted into white unpolished rice for resale to the growers and other Malays. Of the latter, only three are operating—one of medium capacity and two large mills. Each of these three mills is supplied with padi shipped from Kedah, Province Wellesley and Krian, and the out-turn amounts to some 900,000 gantangs of padi per annum. Approximately, 75 per cent. of the padi milled is converted into parboiled rice, the remainder being sold as polished rice.

In North Perak, there are 3 large rice mills, all situated in the Krian District. Two of these mills are owned by the Government—one being located at Bagan Serai and having a capacity of some 200 bags of rice per diem;* the other at Kuala Kurau is about four times as large but has not been worked since 1927 owing to lack of sufficient supplies of padi.

* A bag of rice weighs approximately 227 lbs. (or 170 kati).

The third mill is Chinese owned, situated in Parit Buntar and has a capacity of 200 bags per diem of twelve hours. The Bagan Serai and Parit Buntar mills each produce 50,000—60,000 bags of rice per annum, of which probably 90 per cent. is parboiled. They depend for their supplies almost entirely on Krian grown padi though some padi is usually purchased in Kedah. It may be mentioned that the establishment of Government mills in the Krian District aimed at stabilising padi prices and the encouragement of padi planting by ensuring fair prices for padi locally grown.

In addition to the large mills in Krian, there are a few small power mills on adjacent estates for which Krian padi is purchased at prevailing rates, and these mills handle annually some 400,000 gantangs of padi.

In milling padi by the parboiling process, the products are generally estimated by weight as follows :—Rice 62 per cent., Broken rice 2.2 per cent., Bran 9.2 per cent., Husk 26.4 per cent.

When white rice (polished) is produced if the padi season has been a good one, the milling products show approximately the following proportions :—White rice 62 per cent., Broken rice 2.5 per cent., Bran 5.9 per cent., Cargo bran 6.5 per cent., Husk 23.1 per cent.

With the exception of the husk, which affords an efficient fuel for working the mills, all the above products command profitable prices.

Broken rice (white and parboiled) is used occasionally for human food, but generally for feeding pigs and fowls.

Polishings and bran are sold in two grades, and the following figures are the average prices during the last five years at Bagan Serai Mill :—

White Broken Rice	...	averaged	$7.85	per	bag	of	170	kati.
Parboiled Broken Rice	...	„	$6.68	„	„	„	170	„
White Polishings	...	„	$3.30	„	„	„	100	„
Parboiled Polishings	...	„	$2.81	„	„	„	100	„
White Cargo Bran	...	„	$1.41	„	„	„	75	„
Parboiled Cargo Bran	...	„	$1.28	„	„	„	75	„

Prices for by-products vary somewhat in the different mills, depending on supplies and demand.

None of the mills in Malaya are worked at full capacity, since padi supplies are usually much below requirements, though, in good padi seasons, some of the mills can obtain sufficient supplies to keep them going for 8—9 months. Also, padi and rice prices in Malaya are controlled by factors outside the country, and sometimes in consequence local padi milling is not profitable.

This summary of information on local mills is based on reports written by Field Officers in Perak North and in Province Wellesley and by the Principal Agricultural Officer, Kedah, whose assistance is acknowledged.

THE PREPARATION OF COIR FIBRE

BY

B. BUNTING,

Agriculturist.

Native Manufacture.

Opportunity was taken, during a visit to Ceylon in February, 1930, to investigate the coir fibre industry which has long been established in that Colony.

A visit was paid to a small coconut fibre mill, run by a Sinhalese, near Chilaw.

The extractors were locally-made and housed under an open shed made of kajangs.

The coconut husks usually cost about Rs. 3 per thousand delivered at the mill, but when the price of fibre is high as much as Rs. 4 per thousand is paid. The husks are retted in water for a period of 3 to 4 weeks, a large open pit being employed for this purpose.

After the retting is complete the wet husks are passed through the extractors which are in pairs, one machine, with rough spikes, being called the "breaker" and the other, with fine spikes, called the " finisher."

The "breaker" is composed of large wooden drums fitted with coarse iron spikes and the cooly merely presses one half of the husk against the drum, which is revolving at a high speed, and withdraws the main portion of the fibre from the husk. The latter is then reversed and the other half treated in the same way.

The "finisher" is placed alongside the "breaker" so that the partially cleaned fibre can be handed over to the cooly in charge of the finisher. This machine is very similar to the "breaker", except that the drum is set with finer teeth, and removes the balance of fibre from the outer portion of the husk.

The fibrous portion not passing through the machines, but left in the operator's hands, is known as "bristle" fibre. This is removed to an open shed containing a large concrete tank filled with water, where the fibre is washed by hand and sun-dried.

The balance of the fibre passing through the machines, known as "mattress" fibre, is then sun-dried and afterwards passed through a winnowing machine. This machine consists of a revolving screen, open at both ends and placed at a slight inclination to the horizontal.

This work is carried out on contract and the two men in charge of a pair of machines are paid 50 cents per cwt. of wet bristle fibre produced. This usually given about one-third of its weight of dry fibre.

The following is a list of the machines employed in the mill in question—

5 pairs Extractors (i.e., 5 breakers and 5 finishers).

1 Revolving Screen for cleaning mattress fibre.

1 x 24 H.P. Crossley Cold-starting Engine, using liquid fuel.

1 Hand baling Press for mattress fibre.

The bristle fibre was made by hand into bundles of 28 lbs. each and secured with rope, but the mattress fibre was placed in a baling press and made into bales of about 12 lbs. each. The contract for baling was Rs. 24 per thousand bales.

All the fibre is sold in Colombo and the prices realised are (1) Bristle fibre Rs. 9.50 per cwt. and (2) Mattress fibre Rs. 1.40 per cwt. f.o.r. Colombo. The prices are subject to slight variation and the quotation (Colombo 15th February, 1930) were Bristle fibre Rs. 9.35 and Mattress fibre Rs. 1.15.

European Manufacture.

The possibilities of producing coir fibre were discussed with an important Colombo exporter of coir who stated that Ceylon could not compete with Southern India in either the quality or quantity of the coir fibre produced in that country, where it was obviously being run as a cottage industry with little or no capital outlay. The firm had formerly three coir factories working under European supervision, but the returns were so low that two of the factories had been closed down and the only one now left was in the district of Kurunegala. This factory was equipped with locally-made machinery and was capable of dealing with 100,000 husks per week, or 30,000,000 husks a year. It is stated that a minimum of 15,000,000 husks a year is required to run a factory on an economical basis.

In the manufacture of matting it is necessary to use the whole of the fibre from the husk and not separate it into bristle and mattress fibre. Further, in order to obtain a light coloured fibre it is essential that the nuts should be husked while they are still green, which would naturally affect the quality of the copra.

A factory at Kurunegala is equipped with 16 pairs of machines and fitted with concrete retting tanks in which the water can be changed daily so that the quality of the fibre is not affected by stagnant water. The duration of retting in such tanks is reduced to 10 days, whereas the retting in native mills is carried out in dirty stagnant water for a period of 3 to 4 weeks, with the result that the fibre is dark and of comparatively poor quality. Salt-water is quite impossible for retting and as stagnant water discolours the fibre the only alternative is to employ fresh water for this purpose.

It is stated that 20 machines on a 16 hour day will produce 300 tons of bristle fibre and 600 tons of mattress fibre a year from 7,250,000 husks. Further, it is estimated that 24,000 husks will produce 1 ton of bristle fibre and 2 tons of mattress fibre.

The fibre is baled in an hydraulic press in 2½ to 3 cwt. bales, which roughly measure 11 cubic feet per bale.

The price paid for the husks depends entirely on the market price of the fibre and varies from Rs. 1 to Rs. 3 per thousand delivered at the factory.

YIELDS OF TODDY FROM COCONUT PALMS

BY

H. Marsden, B.SC. (Manc.), A.I.C.,

Chemist, Trade and Customs, F.M.S.

AND

F. L. Skilton, M.C.,

Superintendent, Trade and Customs.

The average daily quantity of toddy produced from a coconut palm is dependent upon a number of factors, the chief of which are enumerated below.

(a) *The age of the palms.* The majority of the palms tapped in the Federated Malay States are over eight years old.

(b) *The length of time in tapping.* Palms should be "rested" and although tapping may be continued for years, the Toddy Contractor usually aims at resting a palm for about four months after it has been tapped for eighteen months.

(c) *The health of the palm.*

(d) *The season of the year.* Generally the worst month for yield is December and the best month is July. Between December and June the yield is increasing fairly rapidly, remains high during June, July and August, and declines rapidly to November and December.

(e) *The skill of the tapper.* A good tapper will produce much more toddy from a palm than will an unskilful tapper.

(f) *Whether a palm is permitted to produce nuts.* Usually, palms are permitted to produce a certain number of fruits. If all the spathes except those tapped for toddy are cut off, a greater yield is naturally obtained.

(g) *Whether the palm is a tall or dwarf variety.* Most of the palms tapped are the ordinary tall variety. The dwarf palm produces less than the tall variety.

Approximately, the lowest yield to be expected in December is a daily average of 2.5 pints per palm. As a rough average throughout the year, 3.5 pints per day per palm may be expected. Individual palms vary considerably, and while some are not worth tapping, others have been known to yield as much as seven pints per day.

The ordinary task of a tapper is twenty-five to thirty, tapped morning and afternoon.

The above observations are based on experience gained at Batu Gajah, Perak, where fourteen tappers under a Head Tapper are employed daily to produce toddy for the Government toddy shops. About 420 tappable palms are available at this centre. They are rested in rotation—usually a complete task is rested and another task taken into tapping. The palms so rested for about four months

after eighteen months tapping have now been used for about eight years. The average of collecting pots is two per palm.

During the latter part of 1927 and early part of 1928, eight coconut palms in the compound of the Institute for Medical Research Kuala Lumpur were tapped twice daily by an experienced tapper. The yields of toddy from each palm were recorded. The age of the palms was not known but all were mature palms which were known to have borne fruit for at least thirteen years, and had not previously been tapped for toddy.

The preparation of spathes on palms A, B, 1, 2 and 3 was commenced on September 9th, 1927, and the collection of toddy on October 1st. The preparation of spathes on palms 5, 6 and 7 was commenced on September 29th, 1927, and the collection of toddy on October, 13th.

The yields of toddy from each of these palms for ten day periods are recorded in the attached table. The yields prior to October 9th were small and are not given in the table.

It is noteworthy that different palms gave very different yields of toddy, and also that the yields from individual palms varied enormously at different periods. The highest ten day yield was 65.9 pints from Palm No. 2 during the ten days ending 27.11.27. This palm yielded more than seven pints a day on fourteen different occasions, the highest daily yield being 8.5 pints on November 11th, 1927. The rainfall was normal during the period, being 50 inches for the six months October, 1927 to March, 1928, and included a wet season in October and a dry season in February and March. The considerable fall in yields in February and March coincided with the dry season, but experiments were not continued long enough to determine definitely whether there is any relation between rainfall and yield. The falling off may have been because the palms should have been rested.

The table shows that the maximum yield for the group of palms was reached about five weeks after the collection of toddy commenced, or about eight weeks after the preparation of spathes was commenced.

These figures relate to a small number of palms only, and it is not known if they can be regarded as typical of palms in the Kuala Lumpur district, or whether data obtained in Kuala Lumpur would be applicable to other districts.

Yields of Toddy in Pints.

10 days ending	Palm A	Palm B	Palm 1	Palm 2	Palm 3	Palm 5	Palm 6	Palm 7	Total 8 palms.	Average yield per palm per day.
18.10.27	13.76	11.88	4.81	30.87	15.11	11.85	8.27	5.61	102.16	1.277
28.10.27	22.74	28.23	12.23	48.28	28.18	27.72	22.23	17.29	206.90	2.586
7.11.27	33.07	33.53	26.26	55.98	36.24	38.18	28.72	24.67	276.65	3.458
17.11.27	32.01	31.52	33.94	65.54	34.06	45.10	34.97	32.96	310.10	3.876
27.11.27	40.15	34.18	33.97	65.92	25.17	41.98	25.60	44.54	311.51	3.894
7.12.27	28.05	32.91	30.88	55.51	25.25	41.59	22.95	47.49	284.63	3.558
17.12.27	28.45	37.29	34.85	51.64	30.03	37.41	28.97	42.98	291.62	3.645
27.12.27	41.17	37.18	24.42	53.93	27.59	25.69	23.29	26.03	259.30	3.241
6. 1.28	44.23	37.04	30.07	48.61	33.16	25.38	29.09	29.30	276.88	3.461
16. 1.28	32.93	30.88	32.96	34.94	28.85	25.64	22.23	28.63	237.06	2.963
Total 100 days	316.56	314.64	264.39	511.22	283.64	320.54	246.32	299.50	2,556.81	3.196

Yields of Toddy in Pints.

10 days ending	Palm A	Palm B	Palm 1	Palm 2	Palm 3	Palm 5	Palm 6	Palm 7	Total 8 palms.	Average yield per palm per day.
26.1.28	38.74	28.41	37.75	36.22	28.41	xx	19.32	34.02	222.87	3.184
5.2.28	28.51	17.99	29.29	44.21	15.70		15.82	25.09	176.61	2.523
15.2.28	33.91	9.82	30.62	31.68	12.71		21.22	32.03	171.99	2.457
25.2.28	9.66	6.29	27.59	7.65	15.08		18.53	22.09	106.87	1.527
6.3.28	7.15	12.40	18.46	13.56	18.57		16.13	29.27	115.54	1.651
20.3.28*	13.44	14.23	17.99	15.81	17.82		27.33	34.27	140.89	2.013
30.3.28	10.69	16.58	14.74	12.66	12.71		17.67	33.34	118.39	1.691
9.4.28	10.59	18.61	20.28	26.95	17.04		11.45	30.90	135.82	1.940
19.4.28	18.40	11.04	23.00	29.44	14.33		8.13	16.69	121.03	1.729
29.4.28	13.54	22.02	23.58	19.63	16.35		11.94	24.06	131.12	1.873
Total 100 days	184.63	157.39	243.30	237.82	168.70		167.54	281.76	1,441.13	2.059

Average yield per tree per day 2.665 pints.

* Palms were not tapped on March 14th, 15th, 16th and 17th.

** Palm No. 5 ceased to yield any toddy on 16.4.28.

Abstracts.

CINCHONA CULTURE IN JAVA*

Owing to the pressure of rapid exploitation of cinchona bark in the forests of Bolivia, stimulated by the constantly growing demand for the product, neither advice or legal regulation proved effective to stem the unbridled exploitation leading to the danger of the extermination of the tree in its natural habitat. This danger increased when, after the discovery that quinine was the most active febrifugal component, the commercial world had learnt to value cinchona bark according to the percentage of quinine it contained, and that from the analyses it appeared that the importation of high percentage barks from South America was constantly diminishing.

This position led to the first attempts of the Netherlands Government in 1852 to transfer cinchona from South America to Java in order if possible, to cultivate the plant in regular plantations. This decision was made not with any idea of financial profit, but to preserve for future generations a medical remedy which had become indispensable and to make it possible to obtain it regularly in adequate quantities.

Consequently, a Dutch expedition in 1852 and an English one in 1860 were sent to South America with the object of collecting as many cinchona plants and seeds as possible in order to transfer these to Java and to British India respectively. The Dutch expedition succeeded in collecting live plants and seeds ot several varieties of cinchona. Of the 500 plants shipped only 75 were alive on arrival in Java. From the seeds, however, a great number of plants were raised.

The British expedition explored the western slopes of the Chimboraza and succeeded in delivering in British India more than 450 live plants and about 100,000 seeds of the *C. succirabra* variety.

Later, the British and Dutch exchanged the varieties that each missed, so that early in the sixties both countries possessed a fair number of cinchona varieties, of which the principal were: *C. lancifolia, C. cordifolia* and *C. Trianae* from Columbia; *C. succirubra* from Chimboraza; *C. officinalis* from Loja; *C. micrantha* and *C. Pahudiana* from Huanuca; *C. caloptera, C. Josephiana* and *C. Calisaya* from Caravaya.

With but few exceptions, all varieties thrived in Java, succeeding best on the planteau of Pengalergen and on the outrunners of the neighbouring moun-

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* Abstract of a lecture entitled "Cinchona Culture in Java. Its history and present situation" delivered by Dr. M. Kerbosch, Director of the Government Cinchona Plantations, Tjinjiuan, Pengalengen at the celebration of the 300th. anniversary of the first recognised use of cinchona, held in the Missouri Botanical Garden, St. Louis (U.S.A.) and published in Geneeskundig Tijdschrift Voor Nederlansch-Indie Deel 71 Aflevering 4; 1 April, 1931.

We are indebted to the Editor for permission to reproduce the two accompanying illustrations which appeared with the original article and for lending to us the blocks for this purpose.—*Ed. M.A.J.*

tains. By further shipments of seed from South America the number of available plants increased rapidly, especially as propagation by cuttings became a practice.

Subsequently, however, it was found that with the exception of *C. officinalis,* all the imported varieties possessed a low percentage of quinine. These barks were objectionable to manufacturers as the preparation of pure quinine from them was rendered more difficult by the relatively high percentage of total alkaloids. Moreover, *C. officinalis,* the bark of which was favoured by manufacturers, gave the least favourable growth and therefore the proposal that this variety should be grown extensively on plantations met with little response.

For a number of years previously the calisaya barks had been the most appreciated on the market. The planters in Java possessed four such varieties. In these varieties the barks appeared to contain an average quinine content of not more than 1—1.5 per cent. The position at this time was therefore, that although cinchona had been preserved from extermination, its cultivation did not promise to be an economic success, since cinchona with a high quinine content could only be produced in insignificant quantities.

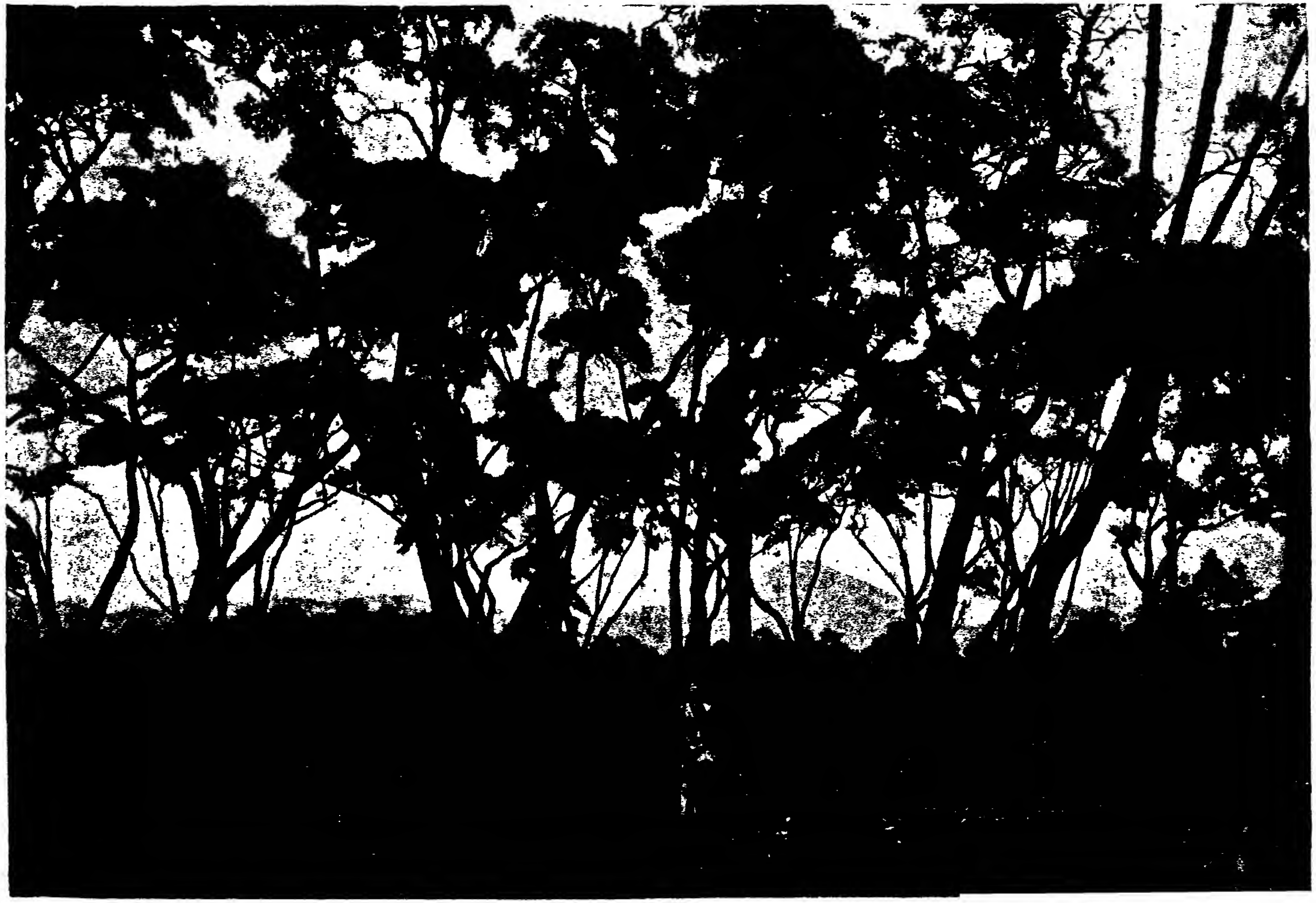
It was about this time (1865) that a new variety of Calisaya seed was received from Charles Ledger. One pound of this seed was purchased by the Netherlands Government, and was sent to Java, while the remaining stock of 13 lbs. eventually came into the possession of the British Government.

The seed purchased from Ledger was planted by the Dutch in December, 1865 and resulted in 12,000 plants reaching the transplanting stage. Analyses of the bark of these trees from 1872 onwards showed a surprisingly high quinine content, ranging from 8 per cent. (the highest percentage found in 1872) to 13.25 per cent. (the highest recorded in 1876). Accordingly, with the increasing percentages of quinine found by analyses of Ledger trees, the Government plantations grew more and more exacting with regard to the qualities of the trees from which seeds and cuttings should be collected.

At this time the Netherlands East Indian Government had for the past 20 years established many plantations, and had spent much time and money on their investigations which had yet shewn no prospects of a reasonably profitable result. Private enterprise was not yet interested in the crop and the public looked on the project as an expensive hobby of the Governors General.

With the advent of Ledger cinchona, the cultivation of this crop assumed a new aspect and attracted private enterprises which accepted from the Government free supplies of seed and cuttings.

Relying on the experience of the Government estates, the planters selected soils of porous structure with much humus and of recent volcanic origin. Such lands at a suitable height above sea level were chiefly found in the Preanger Regencies on the slopes of the volcanoes and on the plateaus between them. This explains the fact that of the present 127 cinchona estates on the island of Java, 85 are in the Preanger Regencies and these together produce almost 75 per cent. of the total Java production.



Original Ledgeriana Trees. 60 Years Old.

Selected Weeding in a Freshly Planted Cinchona Garden.

The development of the cinchona industry owes much therefore to the Netherlands East Indian Government. The success of the policy is evinced by the fact that for many years past the Netherlands East Indian Cinchona Plantations have produced 97 per cent. of the total world production, while British India has produced 2.5 per cent. and the rest of the world .5 per cent.

Generally speaking, the Ledger cinchona is distinguished from the other Calisayas by botanical type and high quinine percentage.

Ledger cinchona was considered as the original form of the genuine Calisaya and named *Cinchona Ledgeriana.* Owing to the ease with which cinchona varieties hybridize, it is probable that *C. Calisaya*, which was found in the same district as *C. Ledgeriana* has been produced by hybridization from the Ledgeriana with other cinchonas.

This fact should be taken into account in order to obtain a correct appreciation of the results obtained with the Ledger seed.

Immediately after the results of the first analyses of Ledger barks had been received, the methods to be adopted were visualised to lie in the direction of encouraging the cultivation of this variety and of improving the Ledgeriana material as much as possible by selection. The general application of quinine as a remedy for Malaria and the indispensability of cinchona bark for its manufacture has justified the first view, while the following will shew the improvements made with Ledgeriana planting material.

In selection work on *C. Ledgeriana,* its high percentage of quinine and its botanical type were the two qualities taken into account. Trees were therefore selected which conformed to type and which possessed a high quinine percentage. Grafts from such trees were planted in isolated fields so that one could collect from them seed produced exclusively from cross-fertilisation of high percentage Ledgerianas. By this method not only was the constant supply of good cinchona seed maintained, but the quality was considerably improved.

The adoption of this method possessed the one serious defect that it led to excessive attention to the percentage of quinine only. Other factors such as vigour and thickness of bark were considered, but played only a subsidiary part in the ultimate selection. Thus the gross amount of quinine, namely the amount of bark produced, was inadequately taken into account.

It is obvious that the amount of quinine produced depends both on the percentage in the bark and the weight of bark produced. Bark production is therefore of equal importance to the quinine content of the bark. A method has been evolved by which a satisfactory estimate can be made of the quantity of quinine which is present at a given moment. The application of this method has elucidated the various factors influencing the production of quinine, such as the quality of the soil, manure and selection.

A large number of experiments have also been made on other cultural and technical points such as planting distance, method of cultivation, and manuring. Grafting methods have been improved and by grafting Ledgeriana cuttings on Succirubra stock it has been possible to produce the Ledgeriana bark on less

fertile soils where Ledgeriana seedlings would not thrive.

In these ways the culture of cinchona was raised to a very high level of technical perfection. The natural result was that Java cinchona culture was able to resist the long periods of depression which frequently occurred. The so-called " Dutch Cinchona Monopoly " has therefore come about by reason of the scientific advice which from the first has supported the cultivation of cinchona and the extraordinary perseverance of the Netherlands cinchona planters.

Over-production was the result of the successful cultivation of cinchona. While the consequent serious fall in prices resulted in the abandonment of this form of cultivation in favour of tea in Ceylon, Java planters concentrated on lowering the cost of production and improving the cultivation of cinchona to withstand these depressions. The maintenance of an adequate supply of cinchona is, therefore, entirely due to the perseverance of the Java planters, who persisted in their efforts in spite of unfavourable circumstances and in spite of the fact that the tea plantations held out better financial prospects.

The Dutch planter need not therefore pay great attention to the views expressed in articles in periodicals and newspapers in which the so-called Dutch Cinchona Monopoly is discussed in a manner which, as a rule, exhibits much unfriendliness, but little knowledge of the true state of affairs. After Ceylon abandoned cinchona cultivation and after most of the private planters in British India had also given it up as not being sufficiently profitable, the Netherlands Indies remained practically alone as a producing country. The so-called monopoly of the Netherlands Indies has therefore come about in an entirely natural way, the way which led to the " survival of the fittest."

Such a monopoly resulting in a main producer is entirely different from monopolies created by special laws and maintained by official regulations. The Netherlands East Indies Government has never tried to maintain a monopoly of cinchona bark production; on the contrary it has repeatedly given its highly selected cinchona seeds to those colonial governments who wished to grow cinchona bark, thus sparing them the trouble and difficulties of work of selection.

It may now properly be asked, what obligations does the special cinchona position impose upon the Netherlands East Indies?

Statistically it is shewn that 650,000,000 people, or a third of the human race, are suffering from Malaria, while 2,000,000 die annually from this cause. For the treatment of these patients 26,000 tons of quinine per annum would be necessary. The conclusion that the production should be increased to 26,000 tons of quinine per annum is exclusively based on theoretical considerations and has no connection with the actual requirements demanded of an economic system of production. Millions of sufferers are so poor that they would be unable to purchase quinine at even the approximate cost of production. In practice the production of quinine can only take into account the law of supply and demand.

Cinchona growers in the Netherlands East Indies certainly will not agree with Dr. Balfour, who is responsible for the above-quoted figures, and who thinks that an International Committee should be appointed in order to see how the

production of cinchona bark can be raised considerably. Such a committee would first have to answer the question: how the large stocks owned by Cinchona growers at present and also their normal production can be used to the benefit of malaria stricken countries whilst, at the same time, the cultivation of cinchona is safeguarded and may be maintained on an economically sound basis. It is evident that this question deserves to receive the attention of the League of Nations.

Moreover, this question is of the greatest importance when Malaria has to be suppressed. In support may be quoted the resolution of the Malaria Commission of the League of Nations. "The first and most important thing to do in malarious localities is to arrange for the treatment of the disease by quinine."

While the provision of inexpensive quinine is of great importance, it is clear that as long as interested parties in the struggle against Malaria do not sufficiently take into account the conditions that make quinine production economically possible, all discussions about lower prices and larger production will be vain and worthless.

On this question the Dutch cinchona bark and quinine producers have tried to come into contact with the Malaria Commission of the League of Nations. It has now been arranged that the matter will be discussed by representatives of the Kinabureau and delegates of the Commission. The Kinabureau has also tried to interest the Health Board of the Rockfeller Foundation. The Dutch cinchona planters and quinine manufacturers will be found ready to give all possible assistance if the Foundation decides to apply itself to this task.

The cinchona planters have attempted to preserve an economically profitable cultivation by means of the Cinchona Agreement.

In the past the planters, who were totally unorganised, suffered periods of depression owing to over-production. Manufacturers were the real masters of the market as they had for some years reached a certain degree of co-operation, consequently, it was noticeable that during low prices for the bark there was an ample margin between the prices for quinine in the bark and the quinine as a market product.

Unanimity amongst producers, however, was not reached until their estates had once more been placed in a critical position during the years 1910/1912, owing to the low prices of bark. The new organisation of bark producers opened up negotiations with the quinine manufacturers leading in July, 1913 to the Cinchona Agreement. Until to-day this co--operation has been maintained by fresh agreements. The control of the correct execution of this agreement is entrusted to the Kinabureau in Amsterdam, which is constituted of 6 representatives of the planters and 6 of the manufacturers. The co-operation between producers and manufacturers is not a "trust" arising from a desire to exploit a monopolistic position, but a result exclusively of the imperative need for putting an end to the great variations in price which jeopardised the security of the bark producers. The main object of this cinchona agreement is and will be to ensure as far as possible the continued existence of an economically pro-

fitable cultivation of cinchona.

The agreement has existed for 17 years during which time it has not abused its position by the unreasonable forcing up of prices.

The Government has greatly helped towards making the Cinchona Agreement and as a bark producer, has become a signatory to this agreement, being convinced of its economic importance to the industry. It is absolutely out of the question that the Government, either directly or indirectly, would participate in a measure which would serve as a means of unreasonably forcing up the price of cinchona bark with an eye to purely mercantile considerations. The Government has throughout taken the attitude that they desired to assure a regular production in order to place it within the reach of as many people as possible. A further proof of the official attitude is that Government reserves to itself the right to withdraw from the Association if it is of opinion that the Cinchona Agreement forms an impediment to the supply of cheap quinine to the malarial districts.

The interest of producers cannot lie in a "trust" for forcing up prices, but demands the sale of as much quinine as possible at prices at which a profitable cultivation can be maintained permanently. It is therefore logical that the producers will try, side by side with a normal sale of quinine, to supply as large quantities of quinine as possible at very low prices with a view to the quininisation of malarial regious with impoverished populations.

Without the Cinchona Agreement, the supply of cheap quinine to malarial districts would by no means be assured. Quinine would then frequently become a speculative article in the hand of middlemen who would not be concerned in the supply of cheap quinine to impoverished sufferers from malaria, and the various Governments would not have the assurance of adequate supplies of cheap quinine for many years, a certainty which the Cinchona Agreement now furnishes them.

However strange this may sound, it is precisely the much discussed "Cinchona Trust" which offers the best chance of supplying the malarial regions with cheap quinine.

SHIPMENT OF PALM OIL IN BULK. *

The "Huileries du Congo Belge" are now, regularly and satisfactorily, shipping large quantities of palm oil in bulk.

Palm oil in large quantities is more difficult to handle than other commodities; it requires great and constant care and conditions of perfect cleanliness, and especially is this the case for the superior qualities intended for consumption as food.

The previous method of shipping in wooden barrels of a capacity of about 630 kilograms (about 160 gallons. *Translator*)—proved unsatisfactory because of the difficulties in assembling and handling these heavy barrels and the leakage which amounted to as much as 3 per cent. Local manufacture from locally grown timber proved impracticable and steel drums were also unsatisfactory. If sent out assembled, their landed cost was prohibitive; those sent out in parts to be assembled locally were less costly but did not give full satisfaction, and it was found troublesome to get them back afterwards from the oil dealers. Their capacity was 500 kilos (about 127 gallons. *Translator*).

When, however, the quantities of oil to be shipped became increasingly large, shipment in barrels proved inadequate, especially owing to the difficulties of local transport. It became necessary to make arrangements for shipment in bulk.

Lord Leverhulme, after visiting the Congo in 1912, had already proposed the laying of a pipe-line from Léopoldville to Matadi. Though it has not been possible to carry out his vast scheme in all its details, the oil from our factories on the Upper Congo is now being shipped in bulk all the way to the factories in Europe and the United States of America.

This transport has been organised as described below:—

The oil, produced in the factories on the Upper Congo is, after classification, pumped into storage tanks of 200 tons capacity. From there it is pumped into special tank barges. The oil all the time is under control by our chemists. All tanks are built in independently of ships' hulls and their interior equipment has been reduced to a minimum in order to facilitate cleaning by means of jets of steam. The double hull is a great safeguard in case of accidents. These barges have been found very satisfactory and very few modifications have been necessary since the first ones were built. They are equipped with permanent suction pipe installation for discharging.

After arrival at Léopoldville the barges are moored alongside one of the Company's pontoons which are equipped with powerful pumps and steam boilers. The oil is pumped into large storage tanks, according to its quality. The greater part of the oil is of superior quality containing a small percentage of free fatty acids. These tanks too, are under the permanent control of the chemists.

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* Free translation of an article published in *Bulletin des Matières Grasses:* Vol. XIV, No. 9. 1930.

On both the Congo and the Kasai river these barges are used; the largest can carry 300 tons of produce of which 200 tons is palm oil in bulk.

A new departure has been made by the use of tank wagons, running between Léopoldville and Matadi and the building of a second depôt at Matadi for the storing of the oil before its shipment in the ocean going tank steamers.

We had at first thought that it would be useful, if not necessary, to build the wagon in such a way that it could serve the double purpose of carrying a cargo of merchandise for the return journey to the interior, but none of the various designs submitted answered this purpose. So we decided to build the tank wagons for the purpose of carrying oil only without troubling about a cargo for the return journey; some day they may be useful for carrying a liquid cargo inland.

As the tank wagons had to conform to the requirements of the rolling stock of the railways and had to keep within the rules for the proportion between load and tare, we built tanks with a flat bottom and a nett capacity of 20 tons; the tank is mounted on a chassis very similar to the standard type of 765 mm width; this tank design gives the largest unit that the height of the centre of gravity of the standard chassis and the sharp curves of the track will allow.

Fifty-five tank wagons have been put into use by the Huileries du Congo Belge; they can easily be converted to run on the 1.06 meter wide track of the factory yards and are fitted with pneumatic brakes and automatic couplings. They have given no trouble other than overheating of the boxes, due to no constructional defect, but to the local conditions, especially during the dry season to the prevalence of dust. We have experimented with a special type of box in which the oil circulates permanently. The reports received show that this new type is superior to the standard type with white metal cushions.

Regular cleaning of the tank wagons is essential and is done under strict control; the insides of the tanks have been kept as smooth as possible with the smallest possible number of rivetheads or other projections.

At present, our wagons on the average make only two round trips a month; improvements now being made to the track will, we hope, soon make it possible to make three or four round trips per month and per wagon. We even hope that in the near future it will be possible to run special oil trains that will do the journey from Léopoldville to Matadi in a single day; that would give six to eight round trips per month per wagon allowing for upkeep and overhauling.

The storage tanks at Matadi now have an aggregate capacity of 3,100 tons. There is also a powerful pumping plant and pipe lines for loading the ocean going steamers at the rate of 90 to 100 tons per hour. As each steamer takes 1,000 to 1,500 tons, loading can be completed in one day and this greatly reduces wharfage charges and does not cause any inconvenience to the regular steamer services.

Particular care is taken with the inspection of the ships' tanks and with keeping them in perfect condition, especially as regards cleanliness. A member of the Company's technical staff exercises constant control and is also in charge

of the gauging. The loading is further supervised by the Customs Officers, controlling all operations. The satisfactory result of these methods of bulk shipment is evident from the fact that the total loss of weight is below 0.25 per cent.

As palm oil, even of superior quality, hardens at a comparatively low temperature, it is necessary to make special provision for ensuring that it is in a fluid condition at ports of destination in northern latitudes, especially in winter. The tanks have to be equipped with steam pipe coils and the heating must be under close control prior to arrival at port of destination, as otherwise heavy expenditure would be incurred in unloading.

According to circumstances, Duplex pumps or centrifugal pumps can be used, but all details of their construction and the materials of which they are made, have to be studied carefully beforehand to ensure uninterrupted working and absence of risk of contamination of the oil. For that reason, all built in pumps or pipe coils are ruled out for ships' tanks owing to the difficulty of cleaning them properly. The pipe coils must be of a pattern that can easily be taken to pieces; we have in fact used only movable pumping material. The pipe line too, has to be heated, but it is essential to avoid all direct contact of the oil and the steam.

The Company has also had to erect quay installations in ports of destination for unloading and storing the oil and for forwarding it to the factories.

The foregoing will have made clear the importance of the organisation described; one of its effects has been to relieve the task of the railway and the work at Matadi port. The transport of 10,000 tons of palm oil in barrels would involve handling on the quay and railway transport of more than 20,000 barrels twice, once when arriving empty and once more when going out filled.

Economically, bulk shipment of palm oil does not pay unless the quantity shipped is over 750 to 800 tons per month.

So far we have not yet shipped palm kernels in bulk. Technically it would not seem difficult to organise and the question is under consideration. The organisation of bulk shipment of palm oil will, in fact, make it easier to adopt more modern methods of transport for other products of this Colony.

PADI IN NEW SOUTH WALES.*

Padi has been grown on a commercial scale in New South Wales only since 1924 when 143 acres produced a crop which averaged 65 bushels per acre (1 bushel of padi = 42 lbs.). A permanent Rice Research Station was established in the irrigation area (Murrumbidgee) in 1928, its chief objectives being experiments in (a) breeding and selection of varieties, (b) methods of preparation of soils, (c) optimum seed rate, (d) best time for sowing, (e) use of fertilizers, (f) the control of weeds, and (g) the best crop rotation—at present the best rotation has been found to be rice, fallow, wheat or rice, wheat, fallow.

The estimated annual consumption of rice in Australia is 15,084 tons, while the production from 14,319 acres in 1928—29 was 14,857 tons (24,000 tons padi), so that local requirements are almost met by the present local production. The Murrumbidgee area covers some 79,000 acres, so that there is much room for expansion of production if foreign markets can be found for the rice, or if local consumption can be stimulated.

The retail price of imported (Patna) rice is 6-6½ pence per lb. whereas locally produced rice is sold at 3½-4 pence per lb. The local cost of production of rice, including interest on capital, (15 per cent.) marketing expenses and storage, etc. amounts approximately to £13 per ton, or 1.39 pence per lb.

The difference between the cost of production and retail prices are accounted for by (a) rail freights, (b) inspection, (c) insurance, (d) cartage, (e) receiving at warehouse, stacking and storing, (f) loss in transit, (g) milling, bagging, and loss in weight, (h) overhead charges and distribution charges, (i) millers' profits, and (k) Marketing Board charges. All these charges amount to approximately £7.12.0 per ton and their reduction should be investigated. To stimulate local production it is suggested that the protection of 1d. per lb. be raised to 1½d. per lb. on all imported rices and that foreign markets should be sought for surplus production.

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* Summary of the following two publications: "Rice Growing," published by the Department of Agriculture, N. S. W., and "Tariff Board's Report and Recommendation on Rice," published by the Commonwealth of Australia 1930.

DERRIS ROOT INSECTICIDES.

The value of Derris root in combating the warble fly pest, which does such serious damage to cattle hides, is discussed by R. C. Gant, M. Sc., Agricultural Organiser for Worcestershire, in the "Yorkshire Post."

Following a season of preliminary trials in 1928, Mr. Gant points out, some very definite experiments were carried out in 1929. Among the six preparations used one was so convincing as regards its action in killing warbles, ease of preparation and application and relative cheapness, that it met all the standards laid down for a remedy of the first order. Derris powder, soft soap and water constituted the sole materials of the wash, which, for want of a better name was called derris-soap-wash. The formula was as follows:—Derris powder 1lb., soft soap ¼lb., water 1 gallon.

During the winter, 1929—30, the Agricultural Education Sub-committee for Worcestershire formulated the area demonstration scheme which was carried out in fifteen areas of the county of Worcester between March and June of this year. The National Farmers' Union co-operated so enthusiastically in the movement that some 10,000 head of cattle were dressed four times according to the instructions and conditions laid down in the scheme. In this area demonstration scheme not only was the experimental evidence reviewed and supported; it was corroborated by 244 farmers in the county of Worcester, whose cattle were dressed. Confirmatory reports have also been received from a number of counties which carried out during 1930 a scheme of dressing modelled on Worcestershire recommendations.

One point from the recent Worcestershire work is that while the soluble toxin alone may be a factor in warble destruction, the additional advantage of the suspended powder in the wash must not be overlooked. The fine particles carried in the soapy wash during dressing effectively plug the breathing holes of the grubs, causing death by suffocation. There is thus a dual action, which makes a 100 per cent. kill quite possible. Stress is, therefore, laid upon keeping the wash well agitated by means of the cloth and hand so that little or no "mud" remains at the bottom of the vessel when the liquid has been used up.

Farmers intending to follow the method advised for destroying warbles are warned that they must obtain Derris powder of proved merit; this is not difficult. Large consignments are imported annually into this country, some being specifically cultivated and some consisting of the roots of plants growing wild.—*The Chemical Trade Journal and Chemical Engineer,* January 9, 1931.

MALAYA AT THE BRITISH INDUSTRIES FAIR, 1931.*

The Fair was held simultaneously at Olympia, the White City and Birmingham, from February 16th. to 27th., 1931. Malaya was represented by a Stand in the Empire Marketing Board Section at Olympia. Visitors to Olympia totalled 170,000 representing an advance of 20 per cent. on last year's figures, and came from 74 different countries.

As in previous years, it was endeavoured to set out as comprehensive an exhibit as possible of Malayan products, though once again prominence was given to Oil Palm products and Pineapples. Pineapples occupied a counter extending the whole length of one of the frontages, while the oil palm exhibits were grouped on a central pedestal.

The decorations of the Stand consisted of cut-outs, posters, weapons and implements, "sarongs," basketware and artificial flowers.

The pineapple exhibit consisted of canned fruit in all packings and under a wide variety of labelling and, for the first time, included some very satisfactory samples of crushed pineapple, which should find a ready market for use in the making of jam and confectionery. For the first time, too, ¾ lb. sample tins of pineapple slices were available for sale to the public at 3d. per tin. Each such tin had a specially printed label worded "Malayan Pineapple, Exhibition Sample" and made reference to no particular firms of importers or cannery. The supply of these sample tins was exhausted half-way through the duration of the Fair.

During the morning hours the Stand performed valuable service every day in effecting a liaison between importers of pineapples and retailers, and the great number of enquiries received from foreign buyers gave an illuminating sidelight on the enormous market that might be developed on the Continent for Malayan pineapples. In the afternoons there was constantly an interested crowd listening to talks on the culinary merits of Malayan pineapple and sampling the fruit set out in glass vessels for that purpose. For 6d. members of the public were supplied with a carrier bearing the words "Malaya" and "Buy Singapore Pineapple and Support the Empire" and containing a sample tin of pineapple, a receipt booklet, and a pamphlet describing the growing and canning of the fruit. Demonstrations were also given to shew how housewives anxious to use crushed pineapple, but unable for any reason to obtain it, can make it for themselves by passing cubes through an ordinary mincing-machine.

A fair number of enquiries for oil palm products were received and were handled direct from the Stand.

Other enquiries were concerned with basketware, essential oils, Illipi nuts, Produce Cards, oil palm shell charcoal and coconut shell charcoal, and various rubber products. The lastnamed were referred to the Rubber Growers' Association Stand, situated only a short distance away.

*** Abstract of Report by Mr. H. S. Banner, Publicity Officer, Malayan Information Agency who was in charge of the Malaya Stand throughout the duration of the Fair.**

Literature on all subjects relating to Malaya was available gratis to the public and for this there was a sustained demand, especially from school teachers and students. The enquiry for "Malayan Statistics" was particularly satisfactory.

On February 17th. the Stand was visited by Her Majesty the Queen, the Duke and Duchess of York, and the Duke of Gloucester, accompanied by Miss Margaret Bondfield, Minister of Labour.

As the Royal party approached the Stand, Syed Jaffar, a Penang Malay engaged as an attendant, saluted the Queen with the traditional obeisance of his people, a tribute which Her Majesty graciously acknowledged.

Other distinguished visitors were the Prime Minister, the Lord Mayor of London and the Rt. Hon. J. H. Thomas, M.P.

PUBLICATIONS OF THE IMPERIAL DEPARTMENT OF AGRICULTURE IN INDIA.

The Imperial Council of Agricultural Research has reorganised its publications from the beginning of 1931. The new series are, "The Indian Journal of Agricultural Science," "Agriculture and Live-stock in India" and the "Indian Journal of Veterinary Science and Animal Husbandry." The above publications will take the place of the "Agricultural Journal of India," the "Journal of the Central Bureau for Animal Husbandry and Dairying" and the Memoirs and Bulletins of the Imperial Department of Agriculture in India.

The *format* of the new publications closely follows that of the *Malayan Agricultural Journal* an arrangement which we do not claim originated with us, but which we are pleased to note is becoming more generally adopted for publications of departments of agriculture.

Miscellaneous Article.

SCHOOL OF AGRICULTURE, MALAYA.

Official Opening Ceremony.

The new School of Agriculture, situated at the Government Experimental Plantation, Sedang, Selangor, was opened by His Excellency the Officer Adminstering Government, S.S. and Acting High Commissioner, Malay States, The Hon'ble Mr. John Scott, C.M.G., at 5 p.m. on May 21st., 1931.

The Guard-of-honour, composed of the band and 50 men of the Selangor M.V.I., under the command of Captain Georgi, O.B.E., with Lieutenant Raja Mushahar was inspected by His Excellency who was met on arrival by the Director of Agriculture, Dr. H. A. Tempany, Principal of the School.

Previous to the arrival of His Excellency, military honours were accorded to Their Highnesses The Sultan of Selangor and the Yang di Pertuan Besar of Negri Sembilan and also to the Hon'ble the Chief Secretary to Government.

After inspecting the Guard-of-honour, His Excellency was met by the members of the Advisory Committee of the School and proceeded to the Hall where he was met by a large and representative gathering of officials and unofficials.

The Director of Agriculture, Dr. Tempany, in calling upon His Excellency to open the School stated that the establishment of the School is an important step which has been taken after prolonged deliberation, for the proposals to establish an Agricultural School in Malaya have been under consideration for the past 18 years, the scheme for the present institution being evolved some 5 years ago, while the erection of the buildings has occupied 2 years.

The objects which the school is intended to fulfil are to provide a grounding in the sciences which underlie agriculture, combined with practical training in the agriculture of the principal tropical crops and elementary instruction in subjects some knowledge of which is essential to the make up of a competent agriculturist.

The Director emphasised that while long practice was essential to a knowledge of agriculture, efficiency may be greatly enhanced with the aid of instruction.

After allusion to the advantage which had been taken, in founding the present School of Agriculture, of the experience of other countries where such schools have been operated with success, the speaker congratulated the architects and the engineers of the buildings. He added that the proximity of the School to the Experimental Station will greatly assist the instruction work.

The School, which has accommodation for 80 students, opens its doors with about 50 pupils. While the School was founded primarily for the training of Asiatics for the Government agricultural services, the more important direct purpose of the School is that of creating a class of trained men who can be employed as assistants on estates or on the working of their own

THE SCHOOL OF AGRICULTURE, MALAYA
AT
SERDANG, SELANGOR.

properties.

" There are few if any countries," continued Dr. Tempany, " which are more favoured naturally than Malaya, possessing as it does a fertile soil, a well distributed reliable and abundant rainfall, an equable temperature and a wide range of agricultural conditions; there is hardly any tropical crop which could not be satisfactorily grown within the compass of its 52,000 square miles. Moreover, thanks to the abundant prosperity which has been its lot in the past it possesses a magificent system of roads and railways, and river transport is fairly easy in the more remote undeveloped sections. The facilities for development are therefore great, and yet the country is dependent on outside sources for many necessities which could be produced locally. Its agricultural prosperity has been built up largely on one product, with the cessation of restriction and the world slump has come overproduction and a drop in market prices to ruinously low levels. So far the only answer which the country has yet returned to the difficulties engendered by the crisis is to produce more rubber and yet more rubber. It is a difficult thing for a country to change or to broaden its ideas on the subject of production; nevertheless there is abundant food for thought when one realises that last year Malaya imported $139 million worth of articles capable of being grown in this country. This includes 66 million dollars worth of rice, 27 million dollars worth of produce of animal husbandry, i.e. meat, milk, butter and eggs, 24 million dollars worth of tobacco, 10 million dollars worth of fresh fruits and vegetables, 4⅜ million dollars worth of tea and coffee.

For Java the corresponding figures for net imports are approximately—

Rice	57 millions
Animal husbandry products	15 ,,
Fruits and vegetables	7 ,,
Tobacco, tea, coffee and sugar	Nil

and this for a population of 40 millions as against our 4 million. In the Philippines the position is somewhat similar. In both these countries the aim of their Governments has been to stimulate local production and I have reason to believe that the result of this policy has been substantially to mitigate the severity of the present crisis for the inhabitants. I am certain that conditions in Malaya are naturally as favourable to diversified production as are conditions either in Java or the Philippines. It is clear that the present depressed condition sooner or later will pass, but one cannot expect that they will not recur again, greater diversification of production especially with a view to lessening imports seems therefore to be most effective palliative and guarantee for the future.

" The opening of this School," continued the speaker, " is an event of considerable significance as it definitely marks a step towards defining agricultural policy on lines which have already borne valuable fruits in neighbouring countries and quite possibly may prove the forerunner of other steps on parallel lines which will eventually enhance the stability of Malayan agriculture."

The speaker explained that while the School has been founded and is supported by the Straits Settlements and the Federated Malay States Governments,

yet its pupils are coming for all parts of Malaya; for whatever may be the political boundaries between different parts of the country he is convinced that an agricultural policy for Malaya should recognise no such limitations.

The School starts under favourable condition having an admirable site, buildings and equipment. The Government has further appointed a strong Advisory Committee. The result will depend very largely on the staff of the School, the support which it receives from the public and on the pupils themselves. The speaker stated that he is persuaded that Mr. Mann, the Vice-Principal and those associated with him fully realise the important and responsible character of the duties entrusted to them, and he feels assured that not only will they justify their positions, but that every member of the staff of the Department of Agriculture will be willing and anxious to assist towards achieving the success of the aims of the School.

In asking His Excellency to declare the School open, the Director gave an assurance that whatever be the difficulties encountered, the Department would use its best endeavours to deserve success in this important enterprise.

On rising to open the School, His Excellency stated that by his presence he was fulfilling a promise which he made to Dr. Tempany six months ago when he visited the Plantation and inspected the buildings then nearing completion.

In the first place he wished to congratulate Dr. Tempany, the Advisory Committee and the officers of the Department on the successful consummation of this scheme. It must be a matter of supreme satisfaction to them to be able to mark to-day the finish of their work by the opening of the School. He associated himself with the Director in congratulating the Director of Public Works on the erection of this dignified and adequate group of buildings, which had been built for the very reasonable sum of $370,000 and he extended his congratulations also to the architects and the engineers for their share in this work.

He desired further to congratulate the staff and first students of the School on having this fine Institution and on the unique and grand opportunity which now lies in their hands, for on them will depend the whole future success of the School.

Agriculture is of paramount importance to the Malays of this country. Natural conditions of climate, rainfall and soil are suitable and there are few fruits of the earth which Malaya cannot produce, and produce well. The growing of foodstuffs is in some respects more important than the growing of rubber. We grow too much rubber, but we grow too little foodstuffs. The figures quoted by Dr. Tempany of the value of imported foodstuffs are appalling and constitutes a very grave reproach and danger to this country.

Continuing, His Excellency said, "If the old-established methods of agriculture existing in Malaya continue unchanged, one can see little prospect of the present deplorable situation improving. We must improve those methods, we must apply the practice and experience of science to improve them, we must disseminate far and wide over the country new and improved and scientific methods of agriculture. And, in the establishment of this school I see the begin-

nings and the hope and prospect of teaching, applying and disseminating better knowledge and better methods, so that if Malaya cannot become entirely self-supporting in the matter of foodstuffs, it may be least become a great deal more independent of imported materials than it is now.

"This school will train native instructors to teach the villagers how to grow their present crops better, how to breed and care for their domestic animals better, how to grow new sorts of crops.

"This school will also, I hope, teach these things to numbers of villagers themselves who will then return to their kampongs and put into practice the knowledge they have acquired and thereby set an example to their fellows.

"If the high aims and the high hopes of the originators of this school are fulfilled—if staff and students alike live up to the standard and ideals set them—then I foresee an increasingly valuable and successful future in store for the school. It is with that vision before my eyes and with that hope in my heart that I now declare open this School of Agriculture."

Speaking as a member of the Advisory Committee of the School, the Undang of Rembau in thanking His Excellency for his presence, stated that this was proof that the Malayan Governments had the agricultural prosperity of the country at heart. He also welcomed Their Highnesses the Sultan of Selangor and the Yang di Pertuan Besar of Negri Sembilan. Their Highnesses, he stated, had always shewn a keen interest in the welfare and prosperity of their respective States.

The criticism had lately been expressed that the Malay schools were capable of producing nothing but men suitable for employment as clerks. By the provision of trade and technical schools, Government had take steps to enable the local youth to qualify for other forms of employment. The School of Agriculture was another valuable and welcome addition which could be utilised to remedy that unsatisfactory situation.

"Speaking as a Malay," said the Undang, "I would like to express my hope that my countrymen will take advantage of the facilities which this School affords." He hoped that the School would in due course make its proper contribution to the economic advancement of the country.

Speaking, in the absence through indisposition of the Hon'ble Mr. Tan Cheng Lock on behalf of the Chinese, Mr. Choo Kia Peng, C.B.E., said that the Advisory Committee, Dr. Tempany and his staff deserved the thanks of everyone connected directly or indirectly with agriculture for their work in bringing the School to completion. He hoped that the Chinese would take advantage of the facilities offered, and on behalf of the Chinese, wished the School every success.

The Hon'ble Mr. S. Veerasamy associated himself with the remarks of the Dato of Rembau and Mr. Choo Kia Peng, and congratulated all concerned on the inauguration of the School.

The gathering then broke up, Dr. Tempany inviting all to inspect the buildings. Refreshments were served in the hostel dining-hall.

Departmental.

FROM THE DISTRICTS.

The Weather.

With the exception of parts of Perak, the weather throughout the Peninsula was normal for the month, being cooler than in April and with an average rainfall provided by frequent showers and occasional heavy thunderstorms in some localities. In parts of Perak, however, the weather was warm and the rainfall well below the average for May.

Remarks on Crops.

Rubber.—Local prices for rubber from small holdings were slightly lower than in April, being \$8—\$13 per picul for smoked sheet, \$6—\$12 for unsmoked sheet and \$2—\$7 for scrap. In Ulu Langat District of Selangor, small-holders are reported to be preparing lump rubber instead of sheet and to be selling it at \$3.50—\$4 per picul. As the lump rubber contains much water and requires little labour for its preparation the return obtained is approximately the same as from sheet. The production of this lump rubber and the comparatively steady price offered for scrap indicate the existence of a definite demand for a raw product in its simplest form.

In spite of the sustained low price of rubber, small-holders in Kedah have continued to tap their trees severely. On the other hand, however, a definite increase in the number of holdings and small estates owned by Asiatics on which tapping has been stopped is reported from Penang and Province Wellesley, Perak South, Pahang East, the Negri Sembilan and Malacca. In Malacca and possibly also in the Negri Sembilan, the increase of untapped holdings may be due to the commencement of padi planting operations. It was estimated that in Penang 75 to 80 per cent. and in Province Wellesley 70 per cent. of the small holdings were not tapped, the only holdings in tapping being those of which the owners have no other source of income.

It was also noticed that where an owner had some other produce that brought him in a little money, he only tapped a sufficient number of trees to make this amount up to an average daily wage. In nearly all cases the trees were tapped by the owner and his family.

Oidium Leaf Mildew was found to be prevalent in Province Wellesley South, but the attack was mild owing to the showery weather which also caused a decrease of the disease in the Negri Sembilan and Malacca.

The same weather conditions, however, favoured the development of Mouldy Rot disease. Control measures were carried out satisfactorily in most infected areas except in parts of Pahang West where enforcement may be necessary. In Selangor a strong reluctance to purchase better quality fungicides was becoming increasingly apparent.

Padi.—The stem borer *Schœnbius incertellus* was found to be present in many padi nurseries in the inland Districts of Selangor. Counts made during the transplanting of Seraup strains at the Kuang Padi Test Plot showed infections of 4.5 per cent. in Seraup 48 and 4.8 per cent. in Seraup 36 in spite of the destruction of infected seedlings in the nursery. All plants were dipped in tuba root extract before planting. Another stem borer, *Diatraea* sp., was found to be damaging nurseries at Jambu Rias in Bentong District of Pahang.

Most of the stock of 1,000 gantangs of pure strain seed obtained for the Negri Sembilan has been sold to padi planters and a further supply has been ordered. In Malacca 535 gantangs of seed of the strains Siam 29 and Nachin 10 have been distributed to local headmen for trial during the coming season.

Coffee.—The local prices offered for coffee have remained low and about the same as in April, but they continue to vary considerably in different districts. Thus, while the general range has been 9 to 14 cents a kati ($1\frac{1}{3}$ lbs.), in parts of central and southern Perak and in Temerloh District of Pahang it has been 12 to 18 cents, while in Kedah $16.20 per picul is recorded.

The outbreak of the Coffee Hawk Moth, *Cephanodes Hylas* at Bukit Kapar in Selangor continued to be well controlled, while that at Ujong Permatang, after causing considerable damage, was controlled by hand-picking and by the use of a solution of disinfectant and tuba root prepared by the Chinese growers.

The Coffee Berry Borer, *Cryphallus Hampei,* was found on a small isolated area of coffee at Lukut in the Negri Sembilan, nearly six miles from the nearest known infected area.

On an area of about 400 acres of coffee successfully established in an estate in Johore, root diseases and the Red Stem Borer have done slight damage.

Tea.—All the tea fields at the Government Plantation, Cameron's Highlands, produced a definite flush of leaf in April, thus following very closely the habit of the plant at this period of the year in more nothernly climates.

This leaf when manufactured, has almost an abnormal percentage of "golden tip"; thus a "showy tea" that apart from any other characteristics, will always find a place for itself in the blenders' art.

The point of value, however, is the fact that as the tea plants mature in this climate, they take on more of the characters peculiar to them in more temperate regions.

The price of local Chinese grown tea in Selangor remained the same as in April, namely 48 cents per kati for first grade and 24 cents per kati for second grade. There was a further improvement in the management of the tea area owned by Chinese at Sungei Balak, while the results of the manurial trial laid down there in the previous month were very striking.

Tobacco.—The interest in this crop is being well sustained by the Chinese growers in Province Wellesley. Fresh crops were sown during the month, including seed of Jaffna and Javanese varieties distributed by this Department. Considerable difficulty was, however, experienced in the control of leaf eating

caterpillars and the Tobacco Stem-borer *(Gelechia heliopa)*. A demonstration of control by spraying has been arranged.

The headman and local Malays at Batu Kurau in Perak have begun to plant tobacco from seed obtained for them by this Department from Kedah and Province Wellesley. A Chinese variety of tobacco grown near Degong in southern Perak was sold for 40—50 cents a kati.

Food Crops.—Wherever land is available, more particularly land under jungle, as in parts of Kedah, Perak, Pahang and Johore, Malay and Chinese small-holders are taking much interest in the planting of supplementary food crops, especially hill padi, maize, sweet potatoes and tapioca, often with bananas to follow as a more permanent crop.

Fruits.—In Province Wellesley local fruit trees, such as durian, mangosteen and rambutan were carrying good crops of growing fruit. In the Muar District of Johore many fruit trees were flowering.

Vegetables.—An interesting result was obtained from a manurial trial on a Chinese vegetable garden in Kuala Lumpur. A complete fertiliser was supplied by a local firm and the yield of onions from the plot was compared with the yields obtained from similar plots manured with fish and prawn sweepings. The complete fertiliser gave an increase of 50 per cent. as compared with the fish and prawn sweepings, while the costs of the applications were in favour of the complete fertiliser. This result, combined with a similar successful experiment conducted in the previous month with leaf vegetables, has attracted much interest among Chinese gardeners. It is possible that the beneficial effect of the slower-acting fish manure may prove more lasting than that of the quicker-acting artificial fertiliser.

Live Stock.—One pair of Large Black pigs, two Middle White sows and one boar of the same breed were obtained from the Government Experimental Plantation, Serdang, by Chinese gardeners during the month.

There was a further decline in the wholesale price of live pigs.

Notes on Agricultural Stations and Padi Test Plots.

At the Telok Chengai Rice Station in Kedah trials were made of rolling the stubble of the last season's crop to hasten decay. The results were satisfactory. Good showery weather was experienced and both stubble and straw rotted well.

On the Kuang Padi Test Plot in Selangor, stumping, levelling and consolidating the bunds were carried out during the month and resulted in considerable improvement. Transplanting of the long-maturing Seraup strains was completed at the end of the month.

The lease of the Dong Padi Test Plot in Pahang was renewed and considerable improvements to the lay-out of the plot and to its surroundings were effected.

Possession was obtained of padi land in the Rembau sub-district of Negri Sembilan and work was commenced on its preparation for planting in the coming season, particularly on improvements in the supply of irrigation water and the rearrangement of the bunds.

Plant Distributions.

Considerable quantities of yams, both Greater and Lesser, sweet potatoes, maize and vegetable seeds were distributed during the month, principally to school gardens. Orange marcots were sent from the Kuala Kangsar Station to Kroh and Rambutan marcots from Penang to the Agricultural Field Officer, Singapore.

Produce sold included 52½ kati of oranges from the Pekan Station, 4944 oranges from the Kuala Kangsar Station, together with 252 hen eggs and 7 Rhode Island Red cocks.

Propaganda Caravan.

The Rural Lecture Caravan commenced a tour in Malacca on the 25th. May at Kesang Tua. The tour is to last until the 6th. June and centres in all parts of the Territory are to be visited. The programme of displays is the same as that followed for the tour in Batang Padang and Ulu Selangor Districts during April.

Rat Destruction.

In Krian and Province Wellesley the payment of rewards for rat tails was discontinued from the 16th. May. In Province Wellesley all outstanding accounts were settled, the total number of tails paid for during the half month was 518,448 and the total number received since the commencement of this year was 1,078,156, while 20,000 poisoned baits were distributed during the month.

In Malacca 56,818 tails were collected. Continuous rain caused flooding of the padi fields and this rendered difficult the opening up of rat nests in the bunds.

DEPARTMENTAL NOTES.

Advisory Committee of the School of Agriculture, Malaya.

The first meeting of the Advisory Committee of the School of Agriculture, Malaya, was held at the School on April 30th., 1931.

Coffee Beans for Local Sale.

Investigations have been undertaken at the Government Experimental Plantation, Serdang, towards the production of a high class sample of coffee bean for local sale. The results have been very encouraging.

Questionnaire to Copra Producers.

In connection with the work of the Assistant Chemist for Copra Investigations, the Department has recently addressed a questionnaire to all the more important copra producers in Malaya. Recipients of this questionnaire will greatly assist the important research work on copra now being conducted by this Department by making their replies as complete and accurate as possible.

Tours by Senior Staff.

The Director of Agriculture visited Fraser's Hill in connection with the new dairy and poultry farm on May 9th. and 23rd., on the latter occasion being accompanied by the Agriculturist.

He also visited Singapore on May 14th. and 15th. On this occasion he inspected work at the new pineapple experimental station at Lim Chu Kang, visited the Singapore Cold Storage Dairy Farm and one pineapple canning factory. He also conferred with the Under Secretary, the Registrar General of Statistics and the Principal Veterinary Officer.

The Agriculturist visited Cameron's Highlands on May 9th. to 13th. in connection with the work of the Experimental Station.

The Government Entomologist and the Assistant Chemist for Copra Investigations paid a visit of 4 days duration to Kuala Langat District between May 19th. and 22nd. in connection with investigations on the subject of infestation of stored copra by insects. They visited 11 estates and addressed a meeting of the Kuala Langat District Planters' Association on 20th. May.

The Acting Agricultural Chemist visited four oil palm estates during the month in connection with investigations on the efficiency of machinery and on the improvement of the products.

Mr. R. G. H. Wilshaw, Assistant Chemist, visited Fraser's Hill on 16th. and 17th. May to examine the soils on the vegetable area around the new stock farm.

On 19th. and 20th. he visited Parit Buntar, Perak, in connection with the soil survey of the Krian irrigation area.

Appointments.

Mr. J. S. Norman, C.D.A., (Harper Adams) has been appointed a Field Instructor and Superintendent, School of Agriculture, Malaya, with effect from the 2nd. April, 1931. Mr. Norman arrived on the 30th. April, 1931.

Leave.

Mr. N. C. E. Miller, Assistant Entomologist, has been granted seven months and eight days' leave on full pay with effect from the 27th. May, 1931.

Staff Change.

Raja Mohamed bin Raja Aman who was seconded to Kedah as Agricultural Officer for a period of 4 years, returned on 19th. May, 1931 to Headquarters and was appointed Malay Agricultural Field Officer on the staff of the Department of Agriculture, S.S. and F.M.S.

Statistical.

MARKET PRICES.

May, 1931.

Rubber.—Prices appreciated slightly over the very low figures to which rubber had fallen at the end of April, although the average price for May is lower than that of the previous month. Singapore average price per lb. in May was 9.1 cents, London 3d., compared with 9.7 cents and 3.3d. respectively in April.

Palm Oil.—London reports under date of 7th May, 1931 : " Since our last, the market, in common with all other descriptions of oils and oilseed, has further declined and to-day's value of 7 per cent. oil is not more than £16.10.0 per ton C.I.F. according to position and quantity available, which gives a parity on an F.O.B. basis of about £12 (= £15.10.9 basis 18 per cent. f.f.a. C.I.F.)".

Copra.—Following the weakness in consuming centres, the market has shewn a severe decline, in spite of moderate supplies. The price of " Sundried " at the beginning of May was $5.35 per picul, but declined steadily throughout the month to $4/- per picul. The average price of this quality was $4.80 per picul, compared with $5.58 for April. For the " Mixed " quality, the average price was $4.59 compared with $5.33 for April.

Pineapples.—Following the heavy packing and shipping season, supplies are now short and prices shewed some advance during the latter half of the month. Average prices per case for the month were: 1½ lb. cube, $3.20; 1½ lb. sliced flat, $3.09; 1½ lb. tall, $3.37. Corresponding figures for April were $3.20, $3.05, $3.36.

Tapioca.—Prices moved but little during May, although flake tapioca advanced by 20 cents per picul. Average prices per picul were: Flake, fair, $3.32; Pearl, seed, $4.50; Pearl, medium, $5, corresponding prices for April being $3.59; $4.81; $5.50.

Coffee.—On account of small arrivals, coffee prices are firmer in Singapore. Java Robusta appreciated from $17.50 to $18.75 per picul, the average price being $18.19 compared with $17.75 per picul in April. Palambang coffee was quoted from $11.75 to $12.50 per picul, the average being $12.12 compared with $12.14 per picul in April.

Areca Nuts.—Prices continue to decline owing to the small demand from India. Average prices per picul for the various grades were, Palambang Whole $4.81; Bila Whole, $3.94; Kelantan Split $5.25 compared with $6.14; $5.37 and $6.15 in April. For other grades, the average prices ranged as follows:—Sliced, $11.75 to $12.94 according to quality; Red Whole $4.61 to $5.35; Split $3.82 to $4.97, the price within range in each case depending on quality.

Rice.—Further decline in rice prices are recorded in May. Siam No. 1 fell from $162 to $153 per coyan, Saigon No. 1 from $151 to $143, Rangoon No. 1 from $137 to $121. Average prices per coyan for the month were, Siam $157, Saigon $135, Rangoon $126 compared with $164, $153 and $135 in April.

In the padi-growing districts, the price of padi was about 4—5 cents per gantang (Imperial gallon). In the large towns it was slightly higher, while in non-padi growing districts the ruling prices were around 10 cents per gantang.

Gambier.—Featureless market. Cube No. 1 has remained at $15 per picul, while block gambier declined 50 cents to $11 per picul. Average prices for May: Cube No. 1 $15, Block $11.21 per picul compared with $15.37 and $11.31 per picul in April.

Pepper.—Supplies are small and dealers are not keen sellers. The tendency of the market has been towards lower levels. Average prices per picul in May, Singapore black, $18.44; Singapore, white, $32.20; Muntok, white, $33.68. Corresponding prices in April were $20.31; $34.56; $35.56.

Cloves. Average Singapore prices for May were:—Zanzibar, $54.40 per picul; Amboina, $56 per picul compared with $50.25 and $48.62 respectively in April.

Nutmegs.—Average prices in Singapore for the month were:—for 110 per lb. $19.50 per picul; 80 per lb. $25.70 per picul. Corresponding prices in April $20.87 and $25.87.

Mace.—Average Singapore prices for May: Siouw, $56 per picul against $64.50 in April; Amboina, $43 per picul against $47 in April.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce weekly reports for the month and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd., and the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133⅓ lbs. ... ... 1 coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

MALAYA RUBBER STATISTICS   TABLE I

Stocks, Production, Imports and Exports of Rubber, including Latex, Concentrated Latex and Revertex. for the month of April, 1931, in Dry Tons.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Malay States :—																		
Federated Malay States	...	14.788	13,696	9,927	45,025	5,754	35.300	Nil	Nil	Nil	26	12,143	6,575	53,890	28,670	12,864	12.583	...
Johore	...	2,252	4,417	3.251	14,014	3,519	16,129	Nil	2	Nil	7	861	5,980	2,817	27,579	2,228	4.372	...
Kedah	...	332	1,954	1,830	7,931	853	4.226	Nil	Nil	Nil	Nil	462	2,024	2.502	10,221	432	2,051	...
Perlis	...	9	6	5	28	12	51	Nil	Nil	Nil	Nil	Nil	13	Nil	81	10	9	...
Kelantan ...	...	299	108	217	778	6	1.638	Nil	Nil	9	Nil	92	328	301	2,125	108	102	...
Trengganu ...	..	55	50	86	373	43	186	Nil	Nil	Nil	Nil	Nil	129	Nil	559	55	50	...
Total Malay States	...	17.735	20,231	15,316	68.149	10,187	57.530	Nil	2	9	33	13,558	15,049	59,510	69,235	15,697	19 167	...
Straits Settlements																		
Malacca ...	...	2,827	1.416	1,084	4,578			Nil		Nil		3 985		20,265		2.795	1 364	...
Province Wellesley	...	96	428	391	1,657			Nil		Nil						126	458	...
Dindings ...	...	172	96	69	363	(2) 1,738	(2) 8,117	Nil	15,407	Nil	69.202	6,472	Nil	24,887	Nil	171	80	...
Penang	1,907	5,716	5	5	29			676		3,117						4.986	5	1,630
Singapore ...	2,076	35.506	316	174	747			7.414		31,724		19.338		70,810		33,738	332	1.771
Total Straits Settlements	3,983	44.317	2,261	1,723	7.374	1,738	8.117	8,090	15,407	34 841	69,202	29,795	Nil	115,062	Nil	41,456	2.239	3,401
Total Malaya	3.983	62,052	22,492	17,039	75,523	11.925	65,647	8.090	15,409	34,850	69,235	43,353	15,049	175.472	69,235	57.153	21.406	3,401

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	9,740	19,510	2,996	2,171	756	35,173
Crepe	599	11,446	1,475	732	209	14,461
Unsmoked sheet	1,440	2,422	515	189	743	6,914
Scrap and lump	1,085				520	
Total all Grades	12,864	33,378	4,986	3,092	2,228	56,548

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	28,923	113057
Penang ...	9,187	40,609
Port Swettenham.	4,843	19,465
Malacca ...	400	2,341
Malaya ...	43,353	175472

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ...	34,471	140796
Straits Settlements		
Malaya ...	34,471	140496

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] − [2] − [3] − [4] − [5] − [9] − [10]
For the Straits Settlements, the figure represents purchases by dealers from local estates of less than 100 acres during the month.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with the omission of certain explanatory notes, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics S.S. and F.M.S., at Singapore on May, 19, 1931.

GENERAL RICE SUMMARY.

April, 1931.

Malaya.—The net imports of rice into Malaya (i.e. consumption of foreign rice) in April was 34,743 tons.

Of the total imports of foreign rice Siam provided 42 per cent. Burma 47 per cent., French Indo-China 10 per cent. and other countries 1 per cent.

The total exports of rice from Malaya during April, 1931 were 12,445 tons of which only 40 tons were produced locally.

India.—Total foreign exports of boiled rice during January and February this year were 292,000 tons against an average during the same months of the past six years of 290,000 tons.

Siam.—Exports from Siam during the period December, 1930—March, 1931 were 411,000 tons against the five years average (for similar periods) of 505,000 tons.

Tables of interest are given below :—

The retail prices of No. 2 Siam Rice in cents per gantang in the Municipal Markets of the Colony were :—

	Singapore.	*Penang.*	*Malacca.*
1929 Average Jan.—Dec. ...	52	57	52
1930 " " " ...	50	52	50
1931 January	37	44	38
February	35	40	35
March	35	38	36
April	33	38	35

Average wholesale Siam rice prices per ton in Singapore, were in dollars (Straits) :—

	1930	1931				Increase (+) or Decrease (—) per cent. on previous month
	Average Jan. — Dec.	Jan.	Feb.	Mar.	Apr.	
Singapore No. 1 ...	130	94	89	80	77	—3.8
Singapore No. 2 (Special) ...	118	85	80	70	68	—2.9
Singapore No. 2 (Ordinary) ...	108	76	73	65	63	—3.1
Siam White Broken A. 1 ...	86	58	51	48	48	......
Siam White Broken C. 1 ...	81	55	48	45	45	......

Net Imports of Rice into Malaya
(Consumption of Foreign Rice) April, 1930
(in tons)

Into	Tons	Per cent.	Per cent. 1930
Singapore ...	11,869	34	42
Penang ...	6,633	19	20
Malacca ...	2,262	7	4
F.M.S. ...	12,959	37	32
U.M.S. ...	1,020	3	2
Total ...	34,743	100	100

Europe.—According to the London Rice Brokers' Association Weekly Circular dated April 9, 1931, the quantities of rice shipped from the East during the following periods were (in 000 tons) :—

To Europe, period January 1 to April 9.

From	1930	1931	Decrease (—) in Increase (+) or Percentage 1931
Burma	117	100	— 14.5
Saigon	44	41	— 6.8
Siam	12	17	— 41.7
Elsewhere	8	18	—125.0
	181	176	— 2.8

METEOROLOGICAL SUMMARY, MALAYA. APRIL, 1931.

Locality	Air Temperature in Degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day Amt.	Number of days: Precipitation* .01 in or more.	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	92.4	74.1	83.3	95	70	81	76	85.6	85.6	8.01	203.5	1.28	21	17		2		174.15	5.18	42
Bukit Jeram, Selangor ...	90.0	74.4	82.2	92	70	85	76	86.0	88.2	7.65	194.3	1.84	19	15	4	1		195.55	6.52	53
Sitiawan, Perak ...	90.9	74.4	82.7	94	71	85	77	85.6	85.4	8.89	225.8	2.15	19	14	5	1		204.05	6.80	
Kroh, Perak ...	89.9	71.9	80.7	93	68	84	75	83.8	84.2	14.30	363.2	1.65	23	22	4			198.85	6.63	
Temerloh, Pahang ...	92.6	73.9	83.3	95	72	79	76	87.2	87.3	5.53	140.5	2.27	16	11	2	10	1	193.10	6.44	57
Kuala Lipis, Pahang ...	91.9	72.6	82.3	95	70	79	75	84.9	85.2	4.81	122.2	1.06	17	14	18	15	2	206.20	6.87	56
Kuala Pahang, Pahang ...	87.8	75.4	81.6	90	72	81	79	85.2	86.3	8.16	207.3	2.00	17	14	4	1		233.15	7.77	64
Mount Faber, Singapore ...	89.0	75.7	82.3	94	72	80	79	82.6	83.3	6.80	172.7	2.56	19	11	2			179.50	5.98	49
Butterworth, Province Wellesley ...	90.2	75.6	82.9	94	72	88	79	87.0	86.2	4.50	114.3	1.35	21	12	2		1	229.70	7.66	
Bukit China, Malacca ...	86.7	74.4	80.5	91	72	82	76	84.0	85.6	5.53	140.5	0.80	21	16	7			208.30	6.94	57
Kluang, Johore ...	90.4	72.6	81.5	95	70	79	75	83.0	83.5	10.28	261.1	3.04	22	19	9	14		163.05	5.43	45
Bukit Lalang, Mersing, Johore	88.5	73.0	80.7	93	70	76	75	83.5	82.6	6.09	134.7	2.68	16	9				206.55	6.88	56
Alor Star, Kedah ...	91.3	74.7	83.0	96	72	85	77	87.7	87.2	5.86	148.9	1.03	17	15	2	3		234.35	7.81	64
Kota Bahru, Kelantan ...	92.3	74.7	83.5	96	72	84	77	85.9	85.0	0.81	20.6	0.28	6	5				249.20	8.31	68
Kuala Trengganu, Trengganu	90.1	74.1	82.1	93	72	81	76	86.1	86.5	2.49	63.3	0.82	8	6		10		244.15	8.14	67
HILL STATIONS.																				
Cameron's Highlands, Rhododendron Hill, Pahang 5120 ft. ...	74.1	60.5	67.3	77	51	67	68			7.99	203.0	1.75	24	23		4		165.45	5.52	45
Cameron's Highlands, Tanah Rata, Pahang 4750 ft. ...	74.4	57.9	66.1	78	53	69	62	71.3	69.7	7.78	197.6	1.21	24	22		14		149.90	5.00	41
Fraser's Hill, Pahang 4268 ft.	75.2	63.6	69.4	78	59	67	65	73.5	73.7	13.35	339.2	2.34	25	21	3	20	1	145.50	4.85	40

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

Malayan Agricultural Journal.

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THE

Malayan Agricultural Journal.

JULY, 1931.

EDITORIAL.

Rice Production in Malaya.

The recent publication of the Report of the Rice Cultivation Committee directs attention once more to the very important subject of the desirability of producing, within Malaya, a much greater proportion of the internal requirements of this essential foodstuff.

His Excellency, Sir Cecil Clementi, in his speech at the opening of the Malayan Exhibition last year, drew attention to this subject and instanced the experience of British Guiana, which has been converted from a rice-importing country into a rice-exporting country, with advantage to the Colony.

During times of prosperity in Malaya, rice-consumers have usually been in a position to pay the price demanded for imported rice, but there has always been the fear, which was realised between 1919—21, that supplies might fail owing to a general rice shortage. There is no guarantee that a similar condition of affairs will not re-occur at any time.

At the present time, large stocks of rice are held by the main exporting countries, causing a considerable fall in prices. The benefit of this fall in price is lessened by the lower purchasing power of consumers in Malaya.

Furthermore, we fully expect a recovery of rice prices directly trade in other directions becomes more normal. There is also an undoubted tendency for many Eastern nations to produce a smaller proportion of their requirements for their increasing population. This will become accentuated in the future owing to the growth of industrialism in the East. On the other hand, the amount of exportable rice from the main rice-producing countries tends, in normal times, to increase at a slower rate than the foreign demand.

It behoves Malaya, therefore, to place a limit to the uncertainty which is inseparable with the present situation in this respect.

The Report indicates that there is no one scheme of rice production which will provide a solution to this problem; but that salvation lies in the adoption of many proposals detailed in the Report, some small, others more ambitious, but all designed to adapt the conditions peculiar to various parts of the country to the successful cultivation of rice.

Demonstrations to Chinese.

In order that the peasant cultivators might profit by the results of appropriate research work of the Department, instructions and demonstrations among Chinese small holders in Selangor has been regularly undertaken since early in 1930.

Among methods adopted to achieve this object is the organisation of conducted parties at the Government Experimental Plantation, Serdang, where the results obtained as a result of research work can be actually seen and the benefits appreciated.

At the commencement, the instruction was confined to Chinese market gardeners, but soon had to be extended to meet the demands of all classes of Chinese agriculturists, who were not slow in appreciating the advantages to be derived when such were presented in a manner that they were capable of interpreting.

During the period from May to December, 1930, 159 Chinese agriculturists were conducted over the Plantation in small parties, in charges of the technical officer concerned.

The practical results of this work are now becoming evident in such directions as the planting of good fodder grass for carp rearing; in silt pitting, cover cropping, improved pruning and manurial trials on tea areas; the introduction of improved strains of yams in shops patronised by Europeans; the grading up of local pigs by using pure bred boars from the Plantation; manurial experiments on coffee; the use of artificial fertilisers on vegetables and the more cordial relationship between the Department and the Chinese small agriculturist.

Dairying in Malaya.

It is an incontestable fact that stock raising on the plains of Malaya offers difficulties which are of less importance in most other countries. The immediate problems in connection with milk production are concerned with suitable feeding and the protection of stock against disease. These questions require even closer attention in the case of imported stock, for such animals frequently suffer from a lowering of vitality which, together with the change of diet, renders them more prone to disease. Even apart from the influence of change of climate, there is no doubt that many imported breeds are more susceptible to disease than are the local or the cross bred stock.

Research is therefore necessary on the local cultivation of foodstuffs suitable for stock, for unless the stockman can rely on locally grown foodstuffs for the greater part of the requirements of his herd, it will be most difficult to conduct such a venture on a profitable basis except by charging a very high price for the produce.

Consideration of the breeds most suitable for importing into Malaya has occupied the attention of this Department as well as private persons. It is not claimed that the final word has been said on this subject, but it is claimed that considerable advance have been made.

As stated above, imported stock are generally more susceptible to disease than are locally bred or cross-bred stock. At the same time, the advantages of

pure bred stock are so apparent that every effort should be made towards their acclimitisation.

The Singapore Cold Storage Co., Ltd., by the establishment of a dairy and pig farm in Singapore, has added materially to the accumulating data on this subject and it is therefore with pleasure that we include in this number of the *Malayan Agricultural Journal* an account of the general lines on which they have worked and of the results to date.

We hope in the near future to supplement this information by accounts of other work of an experimental nature conducted by the Department of Agriculture, so that the public may have available complete information to guide them in inaugurating similar ventures on an economic basis.

The Malayan Pineapple Trade.

From time to time, attention has been drawn in this Journal to the very important industry which exists in Malaya in the growing and canning of pineapples. The extent of this trade and the strong position it holds on the United Kingdom market may be gathered from the article included in this number.

It is an open secret that a local Conference has been considering the question of Malayan pineapple industry with a view to recommending methods by means of which it may be placed in a firmer position and may be extended.

We do not wish to anticipate the recommendations of the Conference, so refrain from comment at the present juncture, but we would point out that the information published in this number, together with the articles which appeared in this Journal during the year 1930, read in conjunction with the report of the Conference, will be found most useful to students of this subject.

Coffee Arabica.

The opening up of Cameron Highlands has brought into prominence a selection of crops suitable for the climate. We have attempted to place before readers, not only information of the experimental work which is being conducted at that station, but an account of the crops suitable for cultivation at that altitude. Consequently, articles have already been published on tea and cardamoms, and we now include an article on Coffee which should be of value to those who contemplate agricultural enterprise at Cameron Highlands. We would also mention that the Department has in preparation a full account of tea growing and manufacture written by Mr. E. A. Curtler, Assistant Agriculturist, who investigated this subject last year in Ceylon and India.

In connection with the agricultural development of Cameron Highlands, emphasis must be made of the paramount necessity of using every endeavour to prevent soil erosion. The general experience in Ceylon has been that methods with this object have usually been adopted too late. Readers, and particularly those interested in agriculture at Cameron Highlands, are referred to the Ceylon Report of the Committee on Soil Erosion, a review of which appears in the next number of this Journal.

Original Articles.

A SINGAPORE PIG AND DAIRY FARM.

BY

T. D. MARSH,

Assistant Agriculturist.

Introductory.

For some years past The Singapore Cold Storage Co. has been engaged in pig-raising with the primary object of marketing carcases of first class quality and killed at weights similar to those offered for sale in Europe. Such carcases are small and suit the European community in-so-much as the proportion of lean to fat is high. The business is now being extended to cater for the Chinese, who prefer pork from heavier and more mature animals.

Many difficulties were encountered in the initial stages, including introduced disease which caused heavy losses, but the solution of each problem has added to the accumulation of valuable information on this branch of animal husbandry. The farm is conducted on sound methods and most of the early troubles have been surmounted.

During the year 1930 an extension in the agricultural activities of the Company included the establishment of a small dairy herd with the object of producing milk of grade A quality.

The fresh milk supply of Malaya is produced in small dairies chiefly under the control of Indians, the class of cattle kept being mostly nondescript mixtures of Indian breeds, and Murra buffaloes. The methods employed, the buildings that are used to house the cattle, the inferiority of the water supplies, combined with the general lack of the requisite knowledge of modern dairy practice, almost preclude the possibility of the production of high grade milk. In consequence, these dairymen do not enjoy the confidence of the educated classes of the country in the quality of their output, with the result that the public favour the purchase of the imported tinned article. Although such milk may lack certain vitamins, owing to the sterilisation processes through which it has passed, it is nevertheless a clean wholesome food.

The imports in the form of sweetened and unsweetened condensed, natural sterilized, and powdered milk, have grown to a large amount and the value of these imports into Malaya exceeded $13,000,000 during the year 1930.

The Managing Director of the Company realised that there was a demand for fresh milk and in spite of many failures in Malaya in the past by both Europeans and Asiatics to maintain profit-producing dairy herds, the Company has imported European cattle of the Friesian breed with a view to establishing a dairy herd on Singapore Island.

The venture bids fair to become successful in spite of the very severe conditions for introduced breeds of cattle and pigs. It must be realised that this farm is established on the plains only 3 degrees north of the equator. It is probable

that this and the Government Dairy at Serdang, Selangor, are the only instances of established dairies of European stock situated under such intense tropical conditions. Even in Java with the same breed of cattle, it is invariably the custom to maintain the pure breeds on the Highlands, only the cross-bred European and Asiatic cattle, which are more resistant to tropical diseases, being used in diary farms on the lowlands.

Policy.

The policy of the Company is :—

(1) To develop a pig farm having a total number of about 10,000 animals.

(2) To maintain a dairy farm at Singapore to test the effect of tropical conditions over a period, on imported Friesian cattle and if the stock can be kept in a healthy and productive condition it is proposed to :—

(a) Continue the importation of stock and breed from them with a view to the selection of the most hardy and productive animals.

(b) Later, if considered advisable, to establish a stud stock farm at Cameron Highlands for the breeding of high class stock for use on the plains. This farm will also be used as a convalescent station for cattle which are suffering from the effects of the lowland climate.

(c) To establish dairy farms in the vicinity of all large towns of the Peninsula for the production of large quantities of high grade milk for sale to hospitals and to the general public.

The Farms.

The first pig farm was established about 6½ miles from Singapore on the Bukit Timah Road. The soil consists of a yellow clay loam, which puddles badly when wet and bakes during dry weather.

This farm is fairly well protected from the sun by the usual "kampong" shade formed by fruit trees, which has been augmented by perhaps a too liberal planting of West Indian Cherry trees, *Muntingia calabura.* The farm is now carrying about 2,500 pigs.

Owing to the insecurity of tenure and the limited area, 60 acres of virgin jungle land for a second farm for both pigs and cattle was acquired in 1929.

This farm is situated on the Bukit Timah Road about 9¼ miles from Singapore. The land is undulating with a deep gully running through, which carried a stream of excellent water before anti-malarial measures were undertaken. The soil is a well drained fertile loam and overlies granite rocks.

On three sides the area is surrounded by jungle and on the fourth by mature rubber. It is unlikely that the adjacent land will be alienated for agricultural purposes, so that there is little likelihood of squatters commencing stock farming in the vicinity with the consequent danger of introducing disease.

Feeding.

About three-fourths of the area has been clean cleared and planted with Guinea grass, *Panicum maximum,* and Elephant grass, *Pennisetum* sp.; these grasses are showing remarkable growth. A crop of about two tons of green fodder is harvested daily from about 18 acres of grass, which is a very heavy yield. Another grass which appears to be a promising fodder is Kikuyu grass, *Pennisetum clandestinum.*

The balance of the area is fenced and sub-divided, the jungle has been felled, but the secondary growth is allowed to develop to provide shade for the pigs.

The Elephant grass is cut at intervals of eleven days, whilst the Guinea grass is cut every five days. By this method of early cuttings, the harvested grass contains a high percentage of proteins and a low percentage of fibre, which is specially suitable for pig feeding. Grass cut at this stage of growth acts as a mild laxative, which is considered beneficial, particularly under tropical conditions.

In addition to the above liberal supplies of grass fed to all animals, concentrated foods are given, and a certain amount of imported foodstuffs from England.

No special foods are given except separated milk powder, which is used as a food for weaned litters. It is considered that the fresh grass contains sufficient vitamins and most of the mineral salts for all classes of stock.

The foods are not cooked with the exception of a partial sterilisation before shipment of those imported from England. A fairly narrow albuminoid ratio is used. Fish, meat, whale meal or offal are not included in the rations, while the proportion of cereals is kept low as it is considered that these foods are too heating.

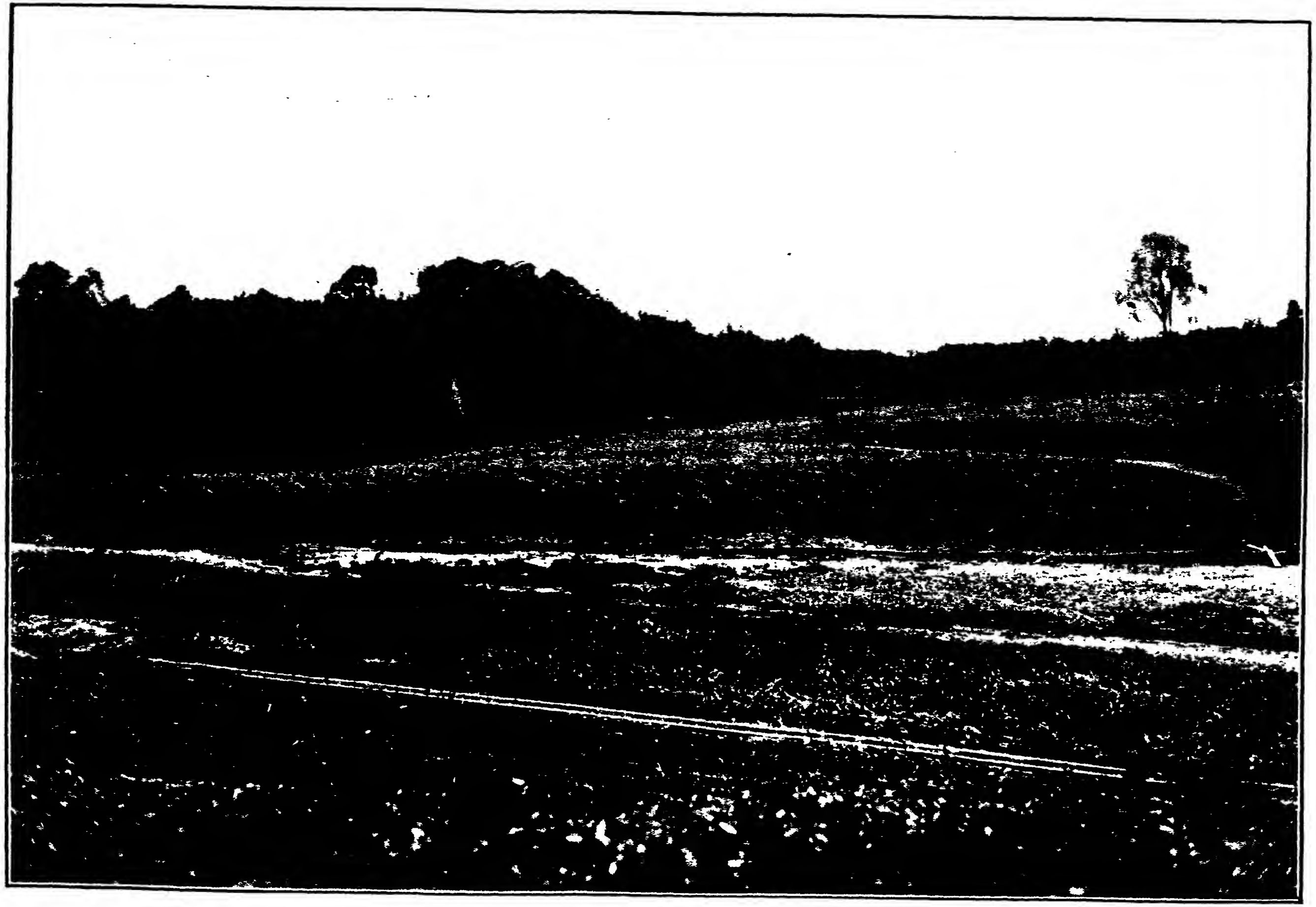
Water Supply.

One of the factors which influenced the selection of the area was the purity and quantity of water flowing through the land; it was considered that this would provide a cheap supply for all the needs of the farm. Owing to a severe outbreak of malaria while the jungle was being cleared, extensive anti-malarial drainage measures were found to be necessary.

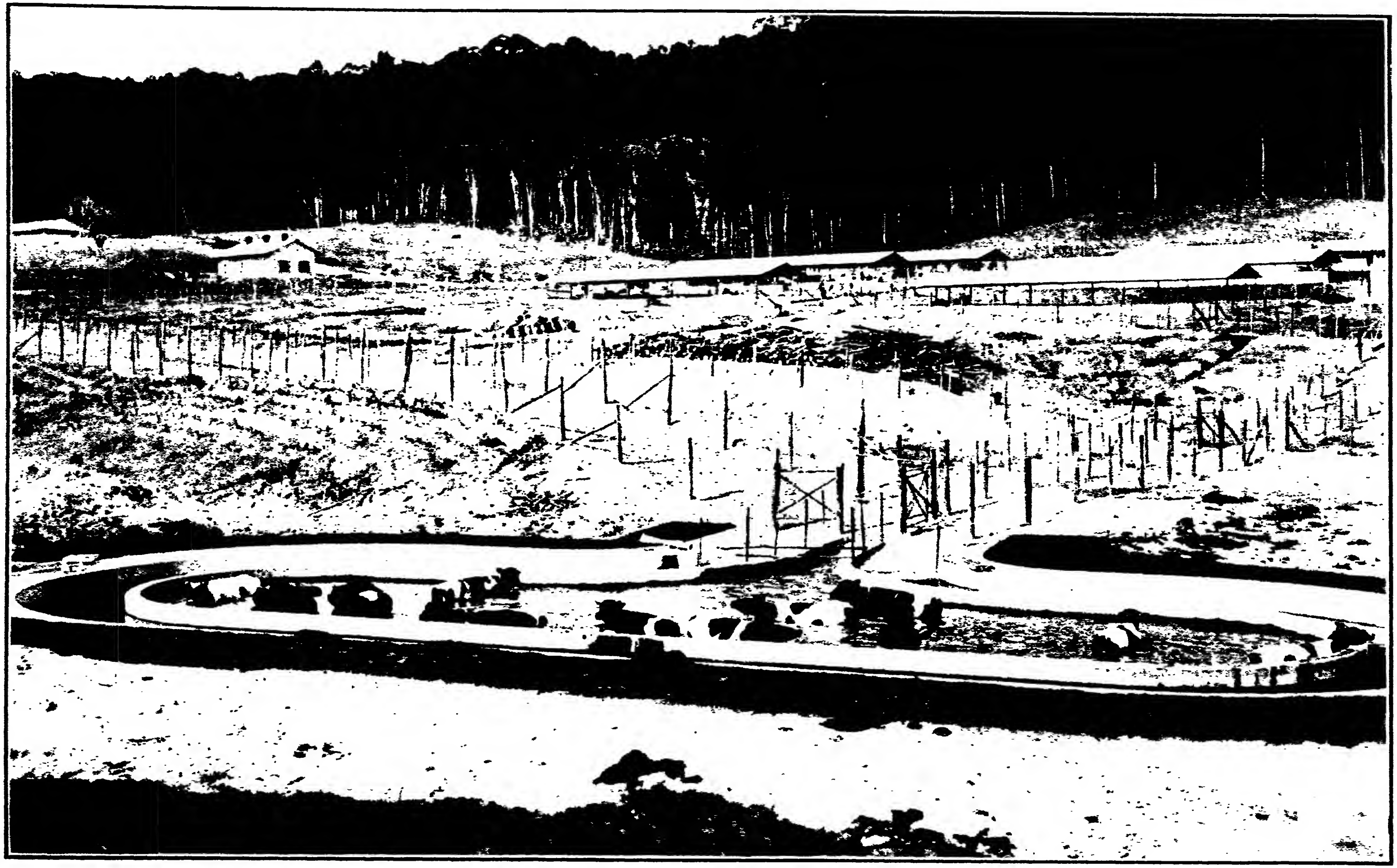
The water supply of the farm and the drainage of the ravines were combined in a general scheme which included the laying of 5 inch sub-soil drains at an average depth of 5½ feet; these drains were laid at the foot of the hills and along the centre of some of the ravines. At the head of the largest gully the pipe drains conduct the water to an underground reservoir which is built above the area that may possibly be contaminated with drainage water from the stock buildings. From this reservoir water is pumped to a large tank situated on a hill, which permits the supply by gravitation to all parts of the farm.

The principal catchment area is on a very steep hill outside the farm boundary.

Water for cleaning purposes runs direct from the high elevation tank to the various buildings, whilst that used for drinking purposes is gravitated to a



Panoramic view of the area planted with fodder grasses.



FRIESIAN CATTLE HAVING THEIR DAILY BATH. THE OUTSIDE BATH IS SEPARATE FROM THE INSIDE ONE, IS SHALLOWER AND IS USED EXCLUSIVELY FOR PIGS.

second storage tank from which it is conducted by pipes to the stock sheds and open yards. The water in this tank is chlorinated daily by the addition of "Caporit" and occasionally a little potassium iodide is added.

Baths.

The overflow from the underground reservoirs with the water from other drains is used to fill large concrete baths of an original design, separate tanks being used for cattle and pigs. The water level in these baths can be regulated to suit the class of stock using the baths.

The cattle bath can be filled to a maximum depth of about four feet, whilst the pig bath is limited to about two feet. The stock are allowed to stay in the water for 15 to 20 minutes and they are given two or three baths per day according to the weather.

Attendants are on duty all day both in the baths and driving pigs to and fro. A system of races is constructed so that all the pigs on the farm can enter the race leading to the bathing tank and return by another passage to their pen. In this way mixing of bathed and unbathed pigs is obviated.

The cattle, on their return to the shed, pass through a shallow concrete tank about six inches deep containing a mild disinfectant, and sows in-milk pass through a similar tank to disinfect their udders; adhering eggs of parasites or the actual parasites are in this way destroyed.

Health.

The health of all types of stock appears to be excellent and the Farm Manager states that internal and external parasites in his stock are negligible. He claims that there are no ticks on his cattle; and in general, parasites now cause no material damage, although in the past they have proved troublesome.

"Caporit," a proprietary preparation of chloride of lime, is used as a general disinfectant for all purposes and also for chlorinating the drinking water. This preparation is claimed to be superior to the ordinary commercial article.

A sick pig is at once removed from the herd to the Isolation Hospital, while if there is a doubt about the disease the animal is slaughtered for examination and the carcase destroyed as a first precaution against the spread of infectious or contagious diseases.

Swine fever serum is always kept in cold storage in readiness should an outbreak occur. In the past some trouble was caused by "three weeks diarrhoea", which occurs in suckling pigs at this age. This has been prevented by painting the navels with iodine at birth and once every few hours afterwards, and by using a "Caporit" udder bath for the mothers. All buildings are limewashed once every two weeks with a spraying machine, 4 to 5 ounces of "Caporit" being added to each 3 gallons of lime wash. As a blue wall is said to be repulsive to flies an excess of blue is added so that when dry it gives the limewash a deep blue colour.

Drainage.

The farm at the 9th mile has been sub-soil drained under the supervision of the Anti-malarial Department and all the gullies are dry except for occasional storm water.

The system from the cattle sheds and pig styes is of open concrete drains, so that cleaning is facilitated. These drains discharge into a water course at the lowest point on the boundary of the farm.

Fences.

Fences are constructed of woven wire 2½ feet high of about 16 gauge galvanised wire, which costs about $180/- per mile. Six-foot posts are used so that another 2½ feet of wire can be placed above if it is found necessary. A strand of barbed wire is placed about 3 inches from the ground in open pig yards to prevent the pigs from lifting the fence. The woven wire is placed about 1 foot from the ground in the case of cattle fences, thus making the top wire of the fence about 3½ feet high.

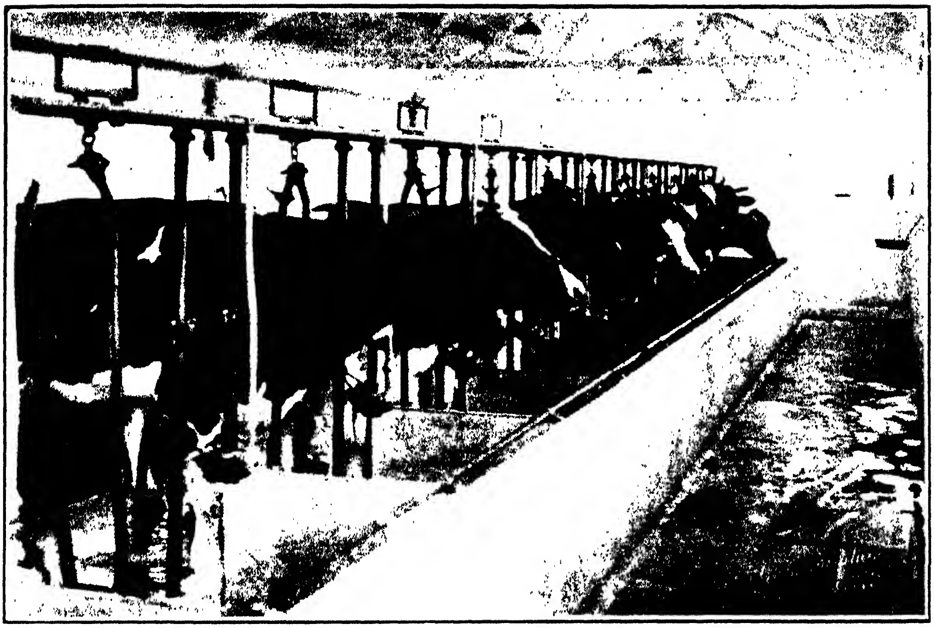
Disposal of Manure.

The attendants collect manure from the cattle shed and pigstyes continuously; this is stored throughout the day in a covered tank on wheels. It is throughly mixed each day with small quantities of lime, " Caporit, " superphosphate, sulphate of potash and sulphate of ammonia, in a concrete mixer and buried in the grass land. It is stated that the addition of sulphate of ammonia prevents the breed-of flies; possibly the interaction of the lime and sulphate of ammonia liberates free amonia which prevents the flies from laying their eggs.

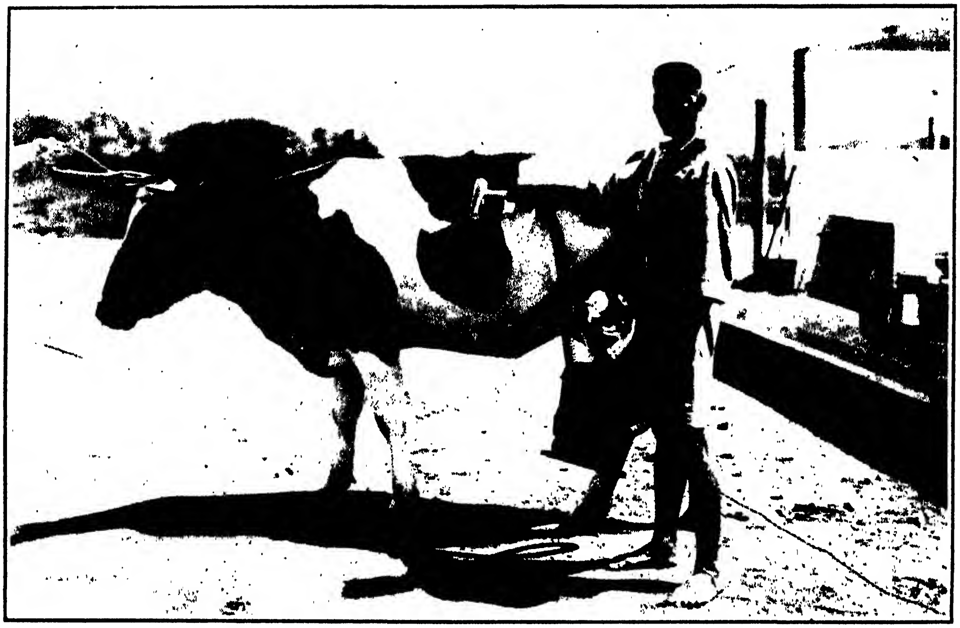
Feeding of Minerals.

The feeding to farm animals of large quantities of fresh succulent grass grown on virgin land with the help of liberal dressings of artificial manure should provide practically all the mineral salts necessary for the bodily functions of farm stock, but as the feeding of minerals in the rations of all farm animals has during the past few years given striking results, additional mineral salts comprising phosphates, lime, iron, sodium, potassium and iodine are added. The mixture is prepared on the farm and is fed in smaller quantities than the usual 2 per cent. of concentrated food consumed.

The Farm Manager claims that liberal feeding of minerals to the native Chinese pigs from the time they are weaned will cause them to stand more upright on their fetlocks and their backs will have a much straighter top line than the usual hollow backs seen in pigs in Chinese holdings.



Friesian cattle in the byre showing the feeding troughs, automatic water bowls, and feeding passage.



The electrically driven vacuum cleaner being used on a Friesian cow; the machine is carried by the attendant.

The Pig Farm.

The stock at present on the two farms is more than 2,500 head.

The breeds used are Large White Yorkshire crossed with Chinese native sows. As the stock tends to become too close to the Yorkshire type, that is after three or four generations, a good type cross-bred boar (Large White Yorkshire x native) is used to infuse more or the native blood into the progeny.

These crosses have been very successful; the sows are very prolific and make good mothers. The native Chinese pigs have characteristics that do not permit them to compete in this particular market with pigs having a fair proportion of an admixture of the leaner European breeds. The native sow has the tendency to become too fat, and most of them when in-milk drag the udder along the ground far more than do the cross-bred with the consequent risk of picking up parasites on the teats for the litter to swallow.

Black pigs are not favoured by the Manager and should a sow persist in having litters with black a dominant colour, this trait is sufficient to have her culled from the herd even if she is quite good otherwise.

The general endeavour is to breed with the object of producing a long lean active white pig, fairly close to the large Yorkshire type, having a wide head, well sprung ribs, deep chest, with light shoulders, but heavy hind quarters and good wide loins. All stock are kept in a fairly lean condition until they are put into the fattening pens. It is the custom to allow undergrown weaners to stay with their mother for a week or two longer than the stronger pigs.

A stud of pure Large White Yorkshires is being maintained, segregated from the herd, to provide boars for the whole farm. Tamworths and Middle Whites have been tried, but the latter are too fat for the market and the former are considered to be inferior to the Yorkshire.

It is proposed to introduce the improved "Dutch Land Race" of pigs. This is a popular breed in north-west Continental Europe and has many of the characteristics of the Large White Yorkshire.

Experiments have been tried with crossing other native breeds, and even the wild pig of Malaya has been used. It was thought that the wild pig might have greater disease resisting qualities than the domestic breeds. A strain of the wild pig can now be observed in many of the breeding sows.

The pigs for the European market are killed at a live weight of about 100 lbs. giving a carcase of about 60 lbs., whereas the pigs for the Chinese market are killed to give a carcase up to one picul (133⅓ lbs.)

Importations of stock are made in the form of pregnant sows, mature gilts of the desired type being purchased in England. They are mated to a good boar and shipped about one month later, so that the exporter can be practically certain that the sows are pregnant. In this way a mature sow and litter is imported at a reasonable price. The voyage does not appear to harm the sows, which still have to carry their litters a further two months after arrival in Malaya. By this method the litters have a better chance of becoming acclimatised;

consequently they make better stud animals than imported mature stock which often suffer from the effects of the heat.

Housing.—Various types of styes have been tried, from temporary wooden portable sheds to semi-permanent wooden, and concrete and iron buildings. The type favoured at present is constructed of concrete walls 3 feet high and 4 inches thick, reinforced with woven wire, with two inch angle-irons to support a roof of galvanised iron. No wood enters into the construction of the styes as it is considered that wood harbours parasites, is more difficult to keep hygienic and is less durable.

The size of the pens for all purposes is 10 feet by 7½ feet, the supports are 6 feet high to the eaves and 10 feet to the apex of the gable. Ten such pens are under one roof and they are built in a continuous row. The Manager states that attendants do not ordinarily traverse a shed more than once during their tour of inspection and one row of styes in each shed will be observed more thoroughly than two. The sheds which are spaced 30 feet apart, are built on the slope of a hill and are arranged with the gables facing North and South.

Floors.—Many experiments have been tried to construct a non-damp conducting floor, asphalt alone and mixed with cork being used in different ways. The type of floor favoured after many trials consists of concrete with a layer of impervious felt paper placed 2 to 3 inches below the surface. The brand of paper used is "Pabco building paper"; water-proof cement being used for the top rendering. Guard rails of 1½ inch pipes, situated about 9 inches from the walls and 6 inches high, are used in farrowing pens to prevent the sows from lying on their newly-farrowed pigs.

A passage 6 feet wide on one side of the pen and under the roof is provided so that the total width of the framework of the building is 16 feet, an overhang of the roof of about 3 feet being allowed on each side. Upright supports for the roof are spaced 15 feet apart, that is, in the alternate walls of the pens, the gables being open to the apex of the roof.

Feeding troughs in the pens are made of concrete and lined with white glazed tiles; the inside measurements for each trough are 2 feet long, 4 inches deep and 6 inches wide. It has been observed that mature Large White Yorkshire pigs can conveniently feed from these troughs, but they would probably be too small for short nosed breeds.

Feeding.—This subject has been dealt with in the general remarks on all stock on the farms under this heading.

Open Yards.—At the new farm large runs are fenced and occupied by breeding sows, open sheds being provided in each enclosure.

The carrying capacity of the land is calculated at the rate of 50 to 75 pigs per acre, but each area is periodically rested for at least a month.

The stock is provided with a continuous supply of drinking water, the level of which is controlled in the troughs by ball cocks.

In order to save labour costs, dry feeding of the pigs is practised. Auto-

matic feeders are installed which only permit fresh food being supplied as the previous deliveries are consumed.

In the open yards a certain amount of secondary jungle is allowed to grow to provide shade for the animals.

Stud Boars.—The stud boars are kept in separate yards, which are about one quarter of an acre in extent, an open shed being provided for each boar. The stud boars are segregated from the sows and are used for service with a herd of sows not more often than one day every two weeks.

Labour.—All the employees on the farm are Chinese. The labourers are grouped together for easier working; the work of each man is the complete care of 100 growing pigs, or a similar task with other classes of stock. As the new farm is being built on more modern labour-saving plans, it is considered that an attendant will be able to take complete care of a much greater number of pigs.

General Remarks.—Although heavy losses have occurred in the past due to mistakes and disease, the results to date are sufficiently encouraging to cause the Company to embark on a larger scale of development with a fair capital outlay.

The Farm Manager is confident that he has overcome most of the dangers of the business of pig raising in the tropics, while the carcases produced are filling a demand as far as production at present allows. There is always the possibility of the introduction of dangerous diseases, but the methods adopted are directed to prevent an outbreak on the farm, or an incursion from outside.

The Dairy Farm.

Many importations of dairy cattle, mostly from Australia, have been made in the past with the object of keeping the animals on the plains, and with the hope of being able, by the sale of milk during the first lactation period after arrival, to pay off the capital charges connected with the purchase and transport of the animals to Malaya. It must be mentioned that some people were prepared to lose money on these importations, provided they could obtain a good supply of fresh milk over a fair period.

Many of these importations succumbed to red water fever a short time after landing, others have survived one lactation period, but few have exceeded this time, until the Government imported cattle for the stocking of the dairy farm at the Government Experimental Plantation, Serdang, where for the past 18 months European cattle have proved successful.

The Singapore Cold Storage Co., during October and November, 1930 imported seven British Friesian cows and one bull from England, and 5 Friesian cows from the Java Highlands. Since their arrival in Singapore 4 heifer calves and one bull calf have been calved. All these cattle at the present time are in a sound state of health, the cows are giving a very satisfactory yield of milk, while the calves can be described as being in admirable condition. The importation of pure-bred Ayrshire stock is under consideration.

Housing.—The cattle are housed continuously except for half an hour

morning and evening when they are having baths, and also one hour each in the mornings and afternoons when they are turned into an open yard for sun baths and exercise.

The house is built of reinforced concrete, angle iron standards and corrugated iron sheets. Special flexible glass panels, which permit the passage of ultra violet rays, are built into the roof.

The outside walls are of concrete and are 4 feet 6 inches high with an open space above of 3 feet 6 inches to the eaves, the ridge is about 13 feet high and is surmounted with three "Robinsons patent ventilators" to a twelve-stalled shed. The shed appears to be exceptionally cool. At the end is a foot bath containing a mild disinfectant, through which all the cattle must pass on entering the shed.

A room about 15 feet x 15 feet is included at one end of the building as a calving shed, or for use as a sick bay for non-contagious diseases. Only one row of stalls is accommodated in the shed.

The byre is fitted with the modern type steel stanchions. Automatic water bowls are fitted to the stalls; each bowl has its own valve which is operated by the animal as water is required.

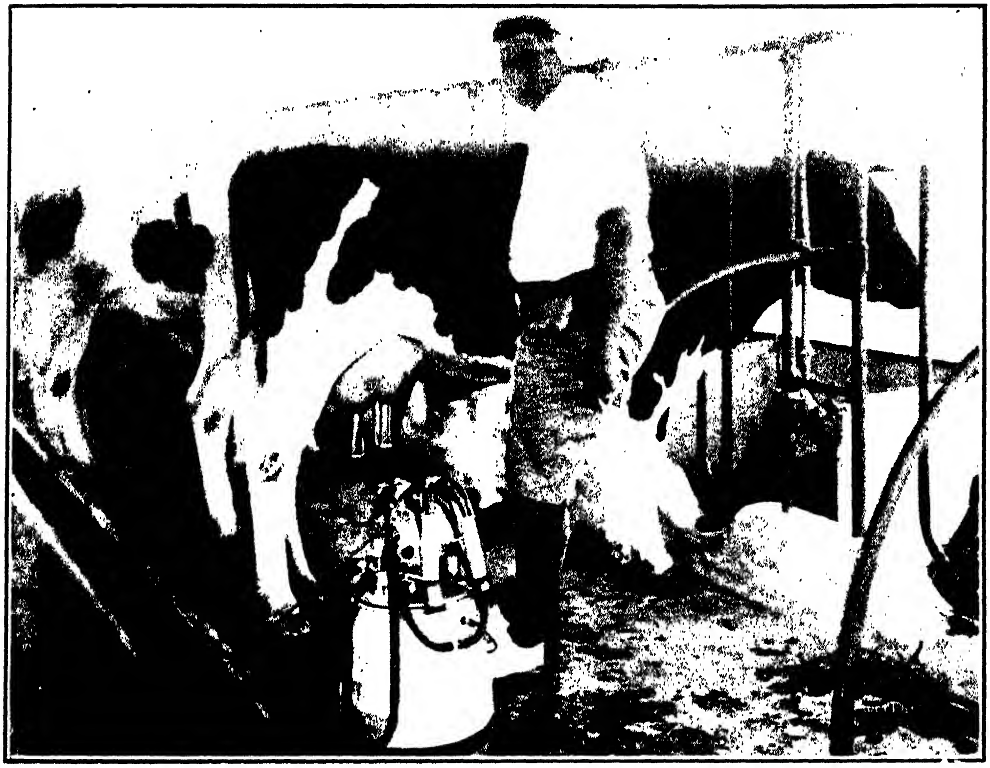
Dimensions of Stalls.—At the head of the cows is a feeding passage 3 feet 9 inches wide. The inside width of the feeding trough is 2 feet 6 inches, the depth of the back of the trough, i.e. adjoining the feeding passage, is 2 feet 2 inches whilst the depth immediately in front of the stanchions is 10 inches. The back of the feeding trough is semi-circular in shape but the front is vertical. The length of the stalls from the trough to the manure channel is 4 feet 9½ inches. The channel is 18 inches wide and 6 inches deep, with a deeper portion at the side furthest from the cows' heels. A passage 4 feet wide at the rear of the cows is included, which is built on a lower level than that of the stalls.

The feeding troughs are of concrete and are continuous throughout the whole length of the feeding passage, with moveable spring loaded divisions which separate the trough into lengths equal to the stall widths, which are 3 feet 6 inches. These divisions pivot on a hinge and can readily be lifted for rapid cleansing of the feeding trough. Ordinarily they separate each cow's food from that of its neighbour.

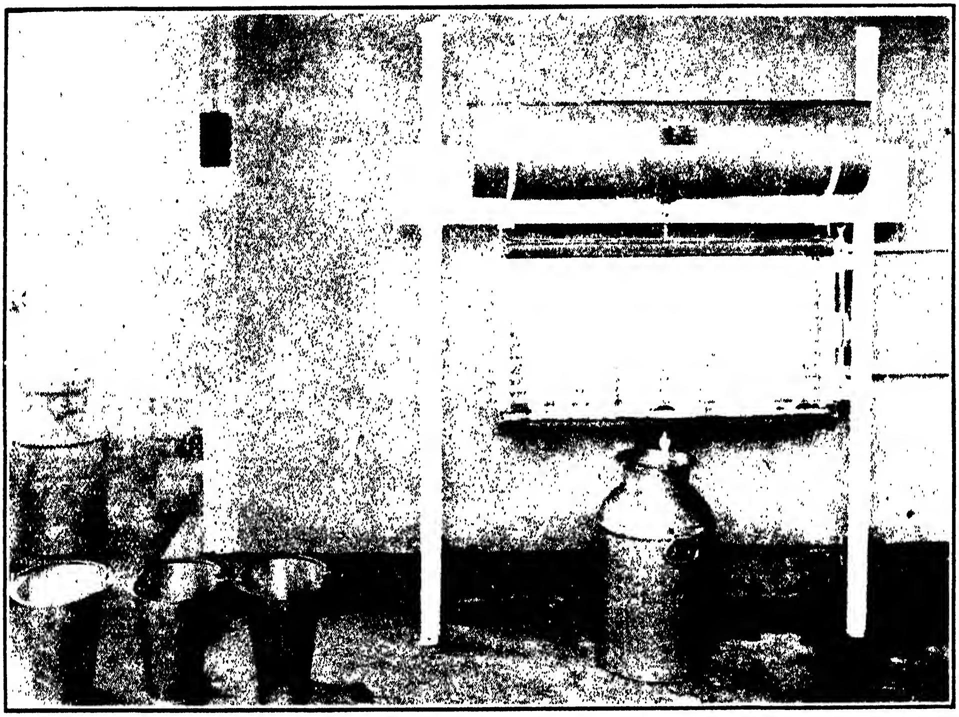
The floors are constructed of concrete with a layer of impervious building paper laid in the concrete about 2 to 3 inches below the surface. A mixture of cement and salt is occasionally painted on the surface to make it less slippery. Trials with cork-asphalt bricks are being made; the results show that this material is not sufficiently durable. A feature worthy of note is that there are in the building no right-angled corners; they are all rounded to facilitate cleaning.

Bedding.—Feeding grass or "lalang grass" is used which has been disinfected with a spray of "Caporit" in water. The bedding is dried before use.

Machinery.—The following is a brief description of the plant and machinery installed on the dairy farm:—



'HE ELECTRIC MILKING MACHINE SHOWING ALSO THE STALLS, STEEL STANCHIONS AND FEEDING TROUGHS.



The milk flowing over the cooler immediately after being drawn.

(1) A separate engine and pump is used to lift the water to the high level storage tank from the underground reservoir, which is situated in the ravine.

(2) The dairy plant consists of a vertical Petter engine and dynamo, which generates current for electric light, power for the electric milking machines, and vacuum cleaner.

(3) A refrigerating plant is installed and run by the Petter engine with a chamber having inside dimensions of about 8 feet x 6 feet x 5 feet and capable of storing the milk for one milking of 200 cows.

The brine circulating pipes of this plant are connected to the milk cooler which is installed outside but adjacent to one of the walls of the refrigerating chamber.

Milking.—Before milking is commenced the floors are all damped, so that dust is less likely to get into the milk after it is drawn. The udders are washed with common soap and a mild solution of "Caporit" in water. The first milk is drawn by hand and is allowed to fall on the floor as the end of the teat invariably contains a large colony of bacteria, which would be sufficient to raise considerably the bacterial count in the milk, after which the machines are fixed on to the teats.

The cows are milked at 5 a.m., 12 noon and 8 p.m. daily. Each cow's milk is weighed on a yard-arm balance in preference to the usual spring scales; the yield so far has been very satisfactory. The milk, as soon as it is drawn, is carried to the milk room, where it is filtered and passed over the cooler; this reduces the temperature to about 35°F. It is then placed in the refrigeration chamber, which maintains an even temperature of about 40°F. It is later transported in bulk to the Central Depot in Singapore, where it is bottled for the retail trade, all handling being carried out under European supervision. The present retail price is 30 cents per pint.

According to the tests made by the Health authorities, this milk compares most favourably with grade A milk in England, the bacterial count varying between 2,500 and 6,000 per cc. which is remarkably low. The butter fat averages about 3.5 per cent.

A departure from standard practice is the method of cleansing and the sterilization of milk utensils, no steam being used. This is carried out with the agency of chlorine solution in water obtained from the favourite disinfectant "Caporit". The results, as shown by the bacterial count, prove that the system is efficient. Tests by bacterial count and carried out in comparison with steam sterilization in the bottling room in Singapore have shown that the chlorine-water solution is the more efficient method.

All the milk utensils are the latest type of seamless articles which facilitates cleaning.

Grooming.—The cows, in addition to having a bath morning and evening, are daily groomed with a special electric vacuum cleaner which massages, cleans

and brushes the skin. All the dirt is collected in a bag, and thus one of the sources of dust is eliminated.

For wounds or sores the proprietary antiseptic "Monsol" is used. Iodine is painted on the navels of calves at birth and again a few hours afterwards.

Labour.—The work is carried out by Chinese who quickly adapt themselves to the conditions and also to the degree of cleanliness required. At present three men do all work of the farm day and night, but the task on a large dairy farm would be much greater.

Feeding.—Feeding is dealt with earlier in the article, but it may be added that the calves are fed on dry "storeletts"which is an imported special proprietary mixture for calf feeding. The mature animals are fed on a balanced ration. The ration might be changed at any time with the fluctuations of market prices. Fresh grass *ad lib* is fed three times daily.

Dipping.—So far it has been found unnecessary to instal a cattle dip, other methods adopted having proved successful in keeping out ticks and other external parasites.

General.—Assuming that dairy cattle in the tropics are correctly housed, fed and generally cared for, their successful maintenance appears to depend upon the complete prevention of attacks on the animals by disease carrying parasites.

The trying effect of a tropical climate on European breeds of cattle is also a serious drawback, but this might be mitigated by the use of a convalescent hill farm to which individual cattle, suffering from the effects of the climate, could be temporarily transferred for recuperation. So far the cows in this dairy have been free from anaplasmosis (gall sickness) and piroplasmosis, (red water fever) which are tick-borne diseases, the latter having in the past caused almost 100 per cent. mortality in imported European breeds; exceptional precautions are incessantly taken to keep the stock free from both external and internal parasites. It will be interesting to observe over an extended period, the effects of a tropical climate on imported European stock which are maintained absolutely free from ticks.

The Company, and in particular the Farm Manager, are to be congratulated on the results so far achieved. Great determination has been shewn in the constant vigil against parasites and no less so in the adoption of suitable modern methods in all branches connected with the development of the Dairy and Pig Farms.

The author takes this opportunity of acknowledging the very great assistance given to him in the preparation of this article by the Singapore Cold Storage Co., and in this connection would especially thank the Managing Director, and the Farm Manager.

The accompanying illustrations were kindly supplied by The Singapore Cold Storage Co., Ltd.

COFFEE IN SOUTH INDIA*

BY

E. A. CURTLER,

Assistant Agriculturist.

South Indian coffee is grown at about 4,000 feet above sea-level. The soil is of medium texture and contains a little laterite, the slopes are not usually very steep, but the general lie of the land is hilly. Most of the coffee appears to be in a healthy condition.

Arabica coffee is the chief variety cultivated in South India. There are also areas of hybrid varieties known locally as " Robusta " although some of the leaves are of the large dark Liberian type; the fruits are in clusters as in the Robusta type, but larger than the Robusta usually grown in Malaya. The older fields are all planted with Arabica seed imported from Mysore, but practically all the new planting is " Kent's Arabica."

The Arabian bush is much more uniform and symmetrical than are the varieties grown on the plains. It has one main central shoot from which the primaries grow parallel with the ground, the secondaries being almost at right angles in the same plane. The " Kent's Arabica " is a very similar bush, but the branches tend to grow in a more upward direction than the Mysore variety and curve over at the ends.

The " Robusta " is usually allowed to grow unchecked and becomes a large bush as much as fifteen feet high, the branches spreading out so that they overlap from about eight feet above the ground.

Planting.

Basket plants are much preferred to " stumps " as they develop very much better in the field and average four inches at two years old instead of only three as in the case of " stumps ", while the general appearance of the basket plants also indicates that they are more vigorous. Another objection to stump planting is that as many as 40 per cent. may die off shortly after planting out.

The planting distance on all estates is 8 feet by 8 feet square at which distance the mature bushes of Arabica just touch, but the " Robusta " intermingle.

The only form of cultivation is the digging of trenches along the spaces between the rows regardless of the contour of the land. These trenches are 18 inches deep, 18 inches wide and usually about 34 feet long, unless there is a natural obstacle such as a rock or a shade tree. If an artificial stop is left it is from 3 to 4 feet long.

The trenches are either cut in alternate spaces and left till they are full of débris, when fresh trenches are cut in the other alternate spaces, or they are cut

* The following is part of the author's report on an official tour of six months in Ceylon and India in 1930.

in every fourth space. In the latter case it is usual to cut a fresh set of trenches each year, so that every space is dug over once in four years. Owing to the porous nature of the soil there are no signs of the overflow from these trenches starting streams down the hill.

Weeding.

The weeding is done by hand or with scrapers. It is essential that the blades be not long enough for the tools to be used sideways and the handles only just long enough to obtain sufficient leverage to remove the roots of the weeds from the soil.

During the monsoons it is usual to hand pull only the big weeds so that the small weeds assist in checking soil erosion; scrapers are only used between the monsoons. As a result of this light weeding, the fields are dirty by the end of the south-west monsoon. During the drought preceding the break of the south-west monsoon practically all the weed growth is killed with the result that "Dry wash" frequently starts.

Shade.

It is quite usual to see coffee grown under jungle shade, all trees of eighteen inches diameter and over being left when the jungle is felled for planting. After completion of the felling, groups of big trees are thinned out so that there is a fairly even stand of shade throughout the field. Some of the coffee growing under jungle shade is of excellent appearance.

The shade tree most commonly planted is *Grevillea robusta,* which grows very well. The planting distance varies between 15 and 25 feet square, the most usual being 20 feet. Closer planting makes the shade rather too close and results in less vigorous growth of the coffee. The object is to create a complete shade, but not so dense as to be definitely dark.

The Grevilleas are often topped at between 18 and 20 feet and kept at that height to encourage the trees to branch. The shade requires to be kept well above the bushes so that it does not " draw " the coffee.

The wild Jack Fruit (*Artocarpus sp.*) is considered to be a suitable tree for shade in coffee. On one estate dadaps (*Erythrina spp.*) were interplanted with the Grevilleas. These trees are topped in September or October, the branches being placed between the rows of coffee. Some of the old dadaps, 40 to 50 feet high, were still looking healthy and being topped annually.

Pruning.

The Arabian variety is usually topped at 4 feet 6 inches. If a bush has been cut back too low, or if the head is broken off, a now shoot is allowed to grow till the brown wood is just below the correct height, at which point it is cut back at the correct height.

The centre of the bush, for 9 inches all round the main stem, is kept open to allow entrance of light and air. With this object in view the bushes are ex-

amined thrice annually, about April, during the south-west monsoon (July—August) and again in October just before harvesting commences. All secondaries within the area are removed and at the same time any suckers from the base are cut off.

The actual pruning is carried out early in the year, when all secondaries growing upward from the primaries and those which cross are cut out; at the same time, any others that have not a good show of flowering buds are removed. Any branch that has started to "die back" is also cut off just in front of the outside living bud.

The pruning system on one estate is as follows:—

If the lower primaries start to die off, the strongest basal sucker is left on the bush and allowed to remain till it attains the correct height for topping. When it is topped, the old stem is cut off just above the base of the sucker so that the old bush is entirely removed and the sucker becomes the main stem of a new bush. This practice is not general since some planters consider that bushes, on which the lower primaries die, should be cut out and replaced by supplies from the nursery.

Harvesting.

In South India coffee flowers from March until May and the bulk of the crop is ripe in November and December; a few odd berries ripen during October and the harvest usually continues into January.

As a general rule, the bushes are not allowed to carry a crop till they are in their fifth year, but some of the more forward bushes may be allowed to carry a small crop during the third year. The primaries are not allowed to carry any crop, all flowers and small fruits being rubbed off when the centre of the bush is cleaned out during the flowering season.

The berries are collected as soon as they are a deep red colour, the fields being gone through as frequently as may be economically possible with the available labour force. The crop per acre varies between 4½ and 5 cwts. per annum.

Manuring.

The coffee is usually manured twice a year, in April and in October. For the first application, the dressing is 2 cwts. per acre and for the second it is increased to 3 cwts. On some estates even more than this is normally given. but owing to the low price of coffee in 1930 manuring had been considerably reduced and in some places entirely omitted.

The mixture is sent up by the Agents ready for application so that no exact details as to its ingredients were available. It is generally a complete mixture with nitrogen in the form of sulphate of ammonia, phosphate as bone meal and potash as nitrate of potash.

The manure mixture is applied in a small trench scraped out with the hand, below the perimeter of the branches on the upper side of each bush. Each labourer has a tin which, when full, holds enough manure for one bush and he spreads the manure evenly along the trench previously opened out, then covers

the mixture with a thin layer of soil. This work requires to be closely watched to make certain that the correct amount of manure is applied per acre, since with 680 bushes per acre, a small error in the amount applied per bush becomes an appreciable error in the aggregate.

Pests and Diseases.

Although the coffee berry borer (*Cryphalus hampei*) is common at the lower elevations in South India, it has not yet attacked the up-country areas. In fact, no serious pest was brought to the writer's notice.

The coffee leaf disease (*Hemileia vastatrix*) is common, particularly during October, but the attacks are not virulent. The Mysore variety of coffee is more liable to attack than is "Kent's Arabica," but in no case was the disease serious. It is usual to spray any diseased bush with Bordeaux mixture, but the estimate for this work is frequently reduced or cut out by the Agents.

Occasionally, a case of black leaf rot (*Corticium Koleroga*) occurs. The effect of this disease is to turn all the leaves black and they subsequently fall off the bushes, sometimes collecting together and forming "birds' nests" among the branches.

This disease should be controlled by the collection and burning of all attacked leaves and branches. Bordeaux mixture effectively controls this disease as well as *H. vastatrix*.

Manufacture.

The site for the coffee store, as it is commonly called, should be as high up on the estate as possible, provided that there is an adequate supply of water, a ready access to a road and a sufficient slope so that the pulp can be carried out of the store by gravity assisted by the flow of water.

The water supply must be constant and should be as clean as possible. In order to ensure an ample supply, the ravine down which the stream comes is dammed at a suitable spot to form a reservoir, from which the water can be drawn if the stream runs too slowly. The reservoir also acts as a catch pit for any stones or débris that may be brought down by the stream. To ensure that no stones or débris are carried into the factory, at least three pits must be provided in the duct, while beyond each pit there must be a piece of wire-netting placed across the duct to hold up any leaves or light material held in suspension.

The only machine used in the factory is a coffee pulper, which removes the outer coat from the fruit. This is done by squeezing the fruits between a stationery and a rotating surface. The most common type of machine is one with a narrow wheel of about 30 inches in diameter, with indentations which carry the fruit along and squeeze it against an inclined plane. The more modern type of machine has a cylinder at the bottom of the hopper which squeezes out the berries from the fruits against an adjustable breast, which can be set according to the size of the fruits that are being pulped. The larger machines of this type are fitted with rotary screens which separate the half-pulped fruits from

those that have been pulped clean. This machine is more efficient than the previously mentioned type which allows half-pulped fruits to pass.

With both types of machines the fruits are carried through by a stream of water, which afterwards flows away with the pulp in suspension, hence the need for a good supply of clean water to the factory.

As mentioned previously, the store should be on the side of a hill, so that the fruit may be brought into the upper floor of the factory at the higher end and stored there. The pulpers are placed on the floor with a shoot leading from the storage room to the machines. The water duct and fruit should be close together, so that one attendant can control the flow of both the machines.

The berries from the pulpers are carried into a fermenting tank, which should be large enough to hold a maximum day's crop when filled to within six inches of the top.

On the up-country estates it is usual to have four fermenting tanks, since at altitudes of between 3,500 and 4,000 feet it is not always possible to obtain a satisfactory fermentation in three days.

The beans are allowed to remain in the fermenting tank till every particle of the mucilaginous layer has been removed by rubbing with the feet of the labourers.

When the berries have been sufficiently fermented they are floated off into the washing tank, which should be twice the area of the fermenting tank and have a separate supply of clean water flowing into it. Beyond the main washing tank is a smaller tank into which all the small and broken berries are floated to keep them separate from the main lot, as their presence in the main part of the crop considerably reduces its market value.

After the berries have been thoroughly washed, they are sun-dried. The drying may be done either on a cement barbecue or on hessian spread over a framework of lathes about three feet from the ground. The latter method has the advantage that it allows a current of air to pass under the beans thus expediting the drying process. If a barbecue is used it should have a convex surface so that all the water can run off rapidly after a shower of rain.

When the beans are thoroughly dry they are packed in sacks for despatch to the dealers.

A shed should be provided at a considerably lower level than the floor of the washing tank. In this shed a conical or pyramidcal frame is erected, which will hold back pulp but allow water to drain through. The pulp from the machines is washed down over the frame and left to drain, as is also the refuse from the fermenting tanks. At the end of the cropping season this pulp is mixed with dadap toppings or other vegetable matter and chemical manures, then kept under cover in the form of a compost for use as a coffee manure in the following October.

THE BAMBARRA GROUND-NUT IN KEDAH

BY

W. N. SANDS,

Principal Agricultural Officer, Kedah.

The Bambarra ground-nut (*Voandzeia subterranea*, Thou) known locally as 'Kachang Poi' or 'Kachang Manila' has been grown for several years past on a small scale in different parts of Kedah, but recently increased interest has been taken in this tropical African leguminous plant particularly in the Kulim District, where quite a considerable acreage is now planted annually, principally by Chinese market gardeners. Recently, in one locality alone, plots of the crop were inspected which had a total area of over 13 acres.

Although small trials have occasionally been made in experiment stations, no previous account of this ground-nut and its cultivation on a commercial scale in Malaya, has been published locally, so that this brief note may be of interest.

The plant is an annual and bears numerous erect long-petioled tri-foliate leaves which are produced from small short creeping stems, whilst the small yellowish coloured flowers are borne on these stems quite close to the ground, and like those of the common ground-nut (*Arachis hypogaea* L.), the flower-stalks lengthen in a downward direction after the flowers have been fertilized and gradually push the young pods under the ground around and below the plants, where they ripen.

The thick mass of foliage which is produced completely covers the ground, even when the plants are spaced two feet or more apart, so that weeds give very little trouble in cultivation.

The class of soil which appears to be most suitable for the crop is a well-drained, sandy loam. Before the seeds are sown the land is well cultivated and levelled. If the soil is rather heavy, ridges about 4 feet apart are sometimes made and the plants grown on these. The usual spacing of the plants on areas with light soil is 2 feet to 2 feet 3 inches square. Two seeds are sown in each hole and the plants mature their small round single-seeded pods in from 3 to 4 months from the time of sowing.

In harvesting the crop, the entire plants are pulled up. The nuts are not easily detached from the plants owing to the tough wiry stalks and very few are left in the ground so that little labour is required for this work.

After reaping, the nuts are hand-picked from the plants, cleaned and sun-dried and then sent to the local market for sale.

The yield of dried unshelled 'nuts' is said to amount to 800 to 1,000 lbs. per acre under suitable conditions and two crops or more can be obtained per annum.

The present retail price in Kedah is 4 cents per kati (1⅓ lbs.) and the nuts are readily purchased both by Chinese and Malays in preference to the common ground-nut, so that all the produce is consumed locally.

The usual local method of preparing the 'nuts' for food is to boil them until they become soft, and shell the beans afterwards. The beans are reported to be of excellent flavour and easily digested and for this reason are much sought after.

In an article published in the *Agricultural Bulletin of the F.M.S.* Vol. 1 No. 7, F. G. Spring stated that seed of the Bambarra nut was imported from Mauritius in September, 1911, and grown in the Experimental Plantation, Kuala Lumpur, but beyond stating that the results were successful, no records are given of yields nor any information regarding the distribution locally of seed obtained. Quoting, however, from an article in the *Tropical Agriculturist* of June, 1911, it is stated that " The yield obtained from the Bambarra ground nut are at least equal to and generally greater than those from the ordinary ground-nut. It is an interesting fact that the composition of the Bambarra ground-nut very closely approaches that of an ordinary normal food ration. Even alone it constitutes a complete food, so that, unlike the others it does not, from this point of view, require mixing with additional foodstuffs. The uses of the plant include the employment of the nut for food, both for human consumption and for stock; the uses of the leaves as fodder and either when fresh or dry, as a " green manure. When the unripe seed is cooked it gives a starchy cum nitrogeneous vegetable, which is much liked, possessing a very agreeable taste somewhat like that of the chestnut. When it is ripe and dry, it may be cooked in the same way as beans and lentils; it does not contain, however, as high a percentage of proteids as these foods. When ground, it yields a very white meal from which excellent broth and soups may be made. Where the fruits are produced in large numbers, they may be used as food for stock; in this case the fact that the covering is consumed as well as the seed gives the product an additional nutritive value."

The Director of Agriculture, S.S. & F.M.S., (Dr. H. A. Tempany) informs the writer that the nut is also a native of Madagascar and that " It is quite extensively grown there and in Mauritius and Reunion for local consumption as a vegetable. It differs from the ordinary ground-nut, *Arachis*, in that it is deficient in oil. The oil-content is under 5 per cent. compared with 20 to 30 per cent. in *Arachis*, it therefore, has no value as an oil-seed for which *Arachis* is chiefly valued as a crop product. In Mauritius it is known as 'Pistache Malgache.' As a vegetable it can be cooked and used in the ordinary way and is in Mauritius also largely used for making soup. As a vegetable it rather resembles Lima beans, but has a curious distinctive earthy flavour which to my mind is rather objectionable."

THE CANNED PINEAPPLE TRADE.*

Imports.

The import into the United Kingdom of canned pineapples in 1929 was nearly 766,000 cwts. as compared with 746,000 cwts. in 1925, but owing to the relatively lower imports during the intervening period the five-yearly average was only some 669,000 cwts., the average import for the period 1920—1924 being 424,000 cwts. In the following tables are shown imports into the United Kingdom since 1925 and the proportions received from the different countries.

Imports of Canned Pineapple into the United Kingdom.

1. Quantities.

COUNTRY	1925	1926	1927	1928	1929	January to October 1930
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
South Africa ...	19,821	22,027	16,017	11,669	13,234	3,422
Malaya ...	604,294	502,065	472,977	514,827	646,952	556,513
Other British ...	2,055	430	2,168	1,384	474	833
Total British ...	626,170	524,522	491,162	527,880	660,660	560,768
U.S.A. and Hawaii.	119,437	83,134	103,735	96,931	101,997	66,731
Other Foreign ...	767	609	1,572	5,271	3,079	5,988
Total Foreign ...	120,204	83,743	105,307	102,202	105,076	72,719
Total Canned Pineapple ...	746,374	608,265	596,469	630,082	765,736	633,487

2. Percentages.

COUNTRY	1925	1926	1927	1928	1929	January to October 1930
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
South Africa ...	2.6	3.6	2.7	1.8	1.7	.5
Malaya ...	80.9	82.5	79.3	81.7	84.4	87.8
Other British ...	.4	.1	.3	.3	.2	.2
Total British ...	83.9	86.2	82.3	83.8	86.3	88.5
U.S.A. and Hawaii.	16.0	13.6	17.4	15.4	13.3	10.5
Other Foreign ...	.1	.2	.3	.8	.4	1.0
Total Foreign ...	16.1	13.8	17.7	16.2	13.7	11.5
Total ...	100.0	100.0	100.0	100.0	100.0	100.0

*The following Memorandum has been prepared by The Empire Marketing Board, to whom we tender our thanks for permission to publish in this Journal.—*Ed. M.A.J.*

It appears from the above tables that the import of pineapples from South Africa is declining both absolutely and relatively, while the proportion of the total supplied by Malaya, in spite of considerable variations in the quantity received during the period under review, is tending to rise. The volume of imports from the United States and Hawaii, and the proportion of the total import also show signs of falling off. It is perhaps too soon to conclude that the declining imports of South African and Hawaiian canned pineapple are a permanent feature of the import position; in both cases the decrease may be due to a temporary fall in the demand for a relatively highly priced article; but it may equally well be due to the general improvement in the quality of the Malayan product.

In 1929, 28.2 per cent. of the total import of all fruits canned in syrup were pineapples as compared with 29.5 per cent. in 1925, the average proportion in the period 1925-29 being 27.5 per cent. as against an average of 28.2 per cent. in the five years 1920 to 1924.

As regards 1930 it seems likely that the proportion of pineapples to other fruits will be higher than in 1928, the reason probably being that the depressed conditions prevailing have caused a comparatively larger demand for the relatively lower priced Malayan supplies which form the bulk of the pineapple imports. Over the ten years ending with 1929, therefore, there has not been much change in the relative position of canned pineapples in the import trade, although the tendency appears to be towards a slight decline. From the consumption standpoint, however, it must be remembered that during that period, and particularly during the past four or five years, the production of English canned fruits has developed to a considerable extent, and the relative decline is therefore more marked than these figures appear to show.

Production Tendencies.

In the following paragraphs statistics of production are reviewed. Exact figures are not available in regard to all sources of supply, but sufficient information is forthcoming as to the most important producing areas to enable a general view of the position to be obtained.

Hawaii. In 1929 the pack of Hawaiian canned pineapple was over 9 million cases and estimates of the 1930 production place the output at nearly 11 million cases, which is appreciably higher than in any previous year. The estimated area in bearing in Hawaii is 50,000 acres, but the American interests which control the industry are known to be seeking further areas in which pineapple canning may be started. This may, in part, be due to the temporary exhaustion of some of the Hawaiian lands, or to the possibility of such a contingency in the future. It has also been suggested that there are signs that production will suffer from the onset of pests, but whatever the reason may be, recent pack statistics do not reveal any decline.

It seems probable in all the circumstances that the production of canned pineapple in Hawaii and other parts controlled by the American concerns will

at least be maintained, and the possibility of an increased output must not be overlooked.

South Africa. Statistics of the production of canned pineapple in South Africa are not given separately in the official statistics. According to the latest figures available the output in 1927-28 of all canned fruits, of which pineapple was probably the largest individual item, was about 60,000 cwts., or approximately 150,000 cases (at a conversion rate of 45 lbs. per case.)

Canned pineapple production in South Africa is comparatively small and there is no indication that the quantity is likely to increase to any great extent in the near future.

Malaya. There are no statistics of the production of Malayan canned pineapple, but total exports give a fair indication of progress and of the extent of the industry. In 1919 a total of 8,200 tons (over 400,000 cases) was exported, and by 1929 the export had risen to nearly 59,000 tons (about 2,900,000 cases).

The whole area under this crop in Malaya is about 50,000 acres, but it appears that less than 5,000 acres of this area is under pineapples as a main crop; in the remainder rubber is the principal crop, and pineapples are planted as a catch crop. As the rubber trees reach maturity pineapples can no longer be grown in this way, and a heavy reduction in output is anticipated unless new lands are opened to cultivation. In view of the importance of the trade every effort is being made to maintain production, and it seems probable that any shrinkage of acreage will be made up by cultivating the pineapple as far as possible as a main crop.

Other Sources of Supply. Among the sources of canned pineapple, not already dealt with, Porto Rico, Australia and Formosa especially may be mentioned.

The production of Porto Rico is still comparatively small, but is tending to increase. No statistics of output are available, but as local consumption is negligible, exports to the United States may be taken as a fair indication. In 1928 some 47,000 cases were sent to the mainland; the quantity had risen in 1929 to about 52,000 cases, but in 1930 more than 126,000 cases were shipped.

Pineapple is also canned in Australia, but the pack is largely consumed locally and has not hitherto entered to any great extent into world trade. The 1930 crop in Queensland was large and is reported to be of good quality; some 7,000 cases of the pack were recently shipped to Canada and it is hoped to continue this development on an increasing scale.

Satisfactory progress is also being made in Fiji where two companies have already commenced operations and a third—the largest Hawaiian company—is conducting experiments with a view to production on an extensive scale. The combined annual output of the canneries at present working is small and probably does not exceed 6,000 cases, but a much larger production may be looked for as soon as an adequate supply of fruit is available.

The industry in Formosa is growing fairly rapidly; in 1926 about 5,500 acres were under pineapple cultivation, and by 1929 the area had increased to

over 9,000 acres with 71 factories, which produced over 20 million cans of all sizes, in operation. The greater part of the export trade is with Japan and Korea, but exports to other countries are growing, and last year (1930) for the first time shipments were made to the United Kingdom.

Among other regions in which pineapple canning may be undertaken in the near future may be mentioned the British West Indies and British Guiana, Mauritius and the Philippines, apart from any developments which may take place in Kenya and other African colonies.

It seems fairly clear that on the whole the world output of canned pineapple is likely to increase materially in the next few years.

At the same time, there seems no reason to believe that world consumptive power is likely to fall short of absorbing an increased output. There are still large areas where consumption is comparatively small. Continental Europe, for example, has not so far been a large consumer of canned pineapple; in 1929 exports from the two main sources, Hawaii and Malaya to Europe were appreciably less than one-quarter of the exports to the United Kingdom from these two sources. With a return to normal prosperity the Continent should be able to take a greater share, but against this must be set the fact that local fruit canning industries are being developed in many countries, and since larger supplies of canned pineapple might be considered to react unfavourably on the sale of the local product, the introduction of measures designed to restrict imports may have to be taken into account. Apart, however, from Europe, the markets of the East, notably India and China, are very largely undeveloped and should be capable, in course of time, of taking increasingly greater quantities.

The Position in the United Kingdom Market.

The market is clearly dominated by the supplies from Malaya which are cheap, and are, therefore, accessible to a large public which cannot afford to buy the more expensive Hawaiian and South African product. Malayan pineapple is found in a number of small shops which do not stock any other canned fruits, though it may be noted that the sale of other canned fruits is becoming more usual in this type of shop.

In the past, Malayan pineapple was generally regarded as quite a separate part of the trade; the fruit as a whole was not comparable in quality and grading with the Hawaiian and South African packs, with which, in a certain sense, it did not compete. This is still to a large extent true, and in addition the difference in price tends to separate the two classes; but the improvement which has recently taken place in Malayan pines, together with the advantages of wider publicity, appear to have brought about their introduction into the market hitherto reserved in large part for the Hawaiian and South African types. No doubt this movement has been accentuated by price differences combined with industrial depression, but there is the possibility that if the improvement in quality is maintained the extended market may be retained unless the prices of Hawaiian and South African pineapples are materially reduced.

Reviews.

Report of the Rice Cultivation Committee.

Two Vols. 54 and 196 pp. Federated Malay States Government Press, 1931.

The Rice Cultivation Committee appointed in July of last year has made a most thorough examination of the problems that confront the padi planter in Malaya and the report is a monumental work that should prove an authoritative source to which administrative officers may turn for guidance in the development of rice cultivation in all part of Malaya.

The Committee was appointed for the purpose of considering " what are the best steps to be taken in order to encourage rice cultivation in Malaya." Doubtless the authorities desired to guard against the re-occurrence of a rice-shortage, such as was experienced in 1919-21, by reason of which the Malayan Governments incurred a loss of $42,000,000 in addition to which there were further unascertained losses to employers of labour. Furthermore, the present annual bill for imported rice amounting to $66,000,000 constitutes a severe tax on the country at a time such as the present, when the value of exports is below cost of production.

The Committee has therefore considered the subject from the point of view of the improvement of the areas at present under cultivation and the possibilities and means of extending the area at present planted.

A progress report of the Committee was published in November, 1930, an abstract of which will be found on page 57 of the present volume of *The Malayan Agricultural Journal.* The present review will therefore avoid, as far as possible, re-iterating the conclusions stated in the interrim report and will be confined to a more general view of the final recommendations of the Committee.

With the object of collecting evidence on the rice-growing problems peculiar to each State, the Committee took the very wise course of forming visiting sub-committees which examined the problems in every part of the Peninsula. The reports of the sub-committees are contained in Appendix 1 of Volume II. The minutes of the twenty-five meetings of the Committee form the second Appendix of this Volume; while Part 3 consists of twelve memoranda dealing with various cognate subjects, such as the history of the Krian Irrigation Scheme and of the Government Rice Mills, padi seed distribution in Krian, rice cultivation by Chinese in Malaya and power cultivation of rice in Southern Siam.

The main report and recommendations of the Committee are contained in Volume I. A summary of the principal findings and recommendations is given and an exceedingly useful Addendum of " Recommendations Regarding Irrigation Works."

Turning to the report itself; preliminary sections deal with general remarks and with the history of padi cultivation in Malaya; conditions under which rice is grown; areas under cultivation and present production; statistical; and the character of padi lands in Malaya.

The Committee is of opinion that in addition to the area already cultivated with rice there is a further potential area of about 600,000 to 1,000,000 acres suited to this crop. It is indicated that such areas should not be diverted from the purpose for which they are best suited—the production of rice. The Land Enactment of 1911 laid down that land suitable for padi cultivation should not be alienated for other purposes except under a special condition requiring that a portion thereof shall be cultivated annually with rice. This Land Enactment was repealed and replaced by a new Enactment in 1926 in which a section corresponding to the above was not included. The Committee recommends that such provision should be re-included by an amending Enactment and that similar provision should be enacted in the other territories of Malaya.

A section of the Report treats of the conditions of tenure of padi lands and the legislation in respect of padi planting. The section states the various forms of legislation which govern the regular planting of the crop. A further section, and this is one of the most important portions of the report if not the most important, considers the question of policy regarding the extension of rice cultivation.

It is evident that there was a sharp divergence of opinion in the Committee on the subject of encouraging and extending rice cultivation in Malaya to alien races, in particular to the Chinese and Indians. Paragraphs 38 and 101 discuss these questions and state conclusions to which three members of the Committee disagreed. The dissentients have stated their opinions in Riders to the Report. A Malay member of the Committee is emphatic that "for many reasons, it is supremely essential that all areas of potential padi land in the Malay States should be made Malay Reservations." The Chinese member, in a memorandum, states the arguments in favour of encouraging Chinese and Indian rice cultivators, while one of the European members thinks that the prosperity and financial security of the Malays will be assured by the infiltration of sturdy rural stock, geographically and ethnographically akin to the local race of Malays.

A large portion of the Report concerns itself with questions of control of water on padi lands. Very rightly, the Committee considers that this is the crux of the question. The present irrigation schemes have been reviewed by the Committee, and the work of the Hydraulic Branch of the P.W.D. examined. The Committee is in favour of the creation of an Irrigation Department and outlines the methods of obtaining liaison between the Irrigation Department, the Department of Agriculture and the Administrative Service. Detailed recommendations regarding the irrigation of existing areas are, as stated previously, included in the Appendix and Addendum of the Report.

Attention is directed to the possibility of irrigating by means of pumps. The findings of the Committee are that the view held until recently that irrigation by pumping is not an economical proposition is probably wrong, in support of which examples of its successful employment in other countries are instanced. Consideration is also given to the possibility of utilising the water stored at the

Perak Hydro-electric Company's dam and it is concluded that any hopes entertained in this respect are unlikely to prove practicable.

The Report discusses and makes recommendations regarding the improvement of existing areas and for the creation of new padi areas. The Report states :

> " Development in two directions obviously lie open : The first comprises the improvement of conditions in existing padi areas together with such immediate extensions to them as may be readily practicable; the second comprises the establishment of new padi areas. We desire to emphasise that, if padi cultivation is to be rendered more stable and production to be materially increased, developments in both directions are essential, but that improvements in existing padi areas are more likely to bring about immediate results than extensions of rice cultivation in new areas. Developments of new areas are likely to be much more easily and quickly achieved if they constitute a definite extension of existing areas rather than the opening up of new territories where padi is not at present grown."

The section enlarges on the application of this finding in relation to particular areas. It will be necessary for the Administrative, Agricultural and Irrigation officers of each State to examine the Report particularly where it refers to their particular areas.

> Regarding mechancial rice cultivation, the Report states : " It is clear that, working in this way, rice can be produced very much more cheaply than under existing conditions of cultivation and the possibility of establishing rice estates is one that should be kept prominently in view."

It is further stated that the consideration of Government should be given to encouraging projects of this description having due regard to the opinion stated on the subject of settlement of population on new areas.

The agricultural services should be extended on the lines already laid down, which have for their object the improvement of varieties of padi, organisation for the distribution of improved seed after being tested at local centres, investigation concerning machinery, research work and its application on pests of padi, and financial assistance of agricultural service to States which are at present unable to finance such service from their own resources.

The continuation of rat campaigns in large areas is advocated. The extension of campaigns of this description should be given consideration in Kedah, Perlis and Kelantan.

It is recommended that in areas where fully adequate water control is possible the growing of two crops of padi per annum should be encouraged and coupled with the use of manures. The reviewer's experience has been that duration of crop has a strict relation to yield in spite of manuring. This no doubt is due almost entirely to the extent of tillering. Neither does closer planting obviate this objection. It is possible that, contrary to the opinion of the Committee, the cultivation of these short duration varieties is only justified in areas where the water supply is inadequate for a long padi-growing season.

The Committee does not recommend the cultivation of dry padi, except in areas in which the water supply is so erratic as to render " wet " padi cultivation impracticable, but recommends that in such areas if extensive, the selection of heavy-yielding strains, manurial methods and crop rotations aiming at the maintenance of soil fertility should be given attention.

The financial position of padi cultivators is discussed. In this connection, the Committee recommends the extension of co-operative principles and greater liaison between co-operative and administrative officers.

The importance of buffaloes in rice cultivation is emphasised, and in this connection it is recommended that when circumstances permit, a Government buffalo stud farm be inaugurated with the object of improving the local breed of buffaloes. Further, it is recommended that research work in the prevention of rinderpest be subsidised and it is suggested that the balance of the Pahang Flood Relief Fund might be devoted to this object and to the improvement of the supply of buffaloes.

The Report contains recommendations concerning the cultivation of foodstuffs on estates. It states that Boards of Directors should be requested to instruct their managers to lay down definite plans in this connection and to see that they are continuously followed. Estates with areas suitable for rice cultivation should develop them as such or surrender such lands to Government for re-alienation for padi cultivation. Where portions of an estate are cultivated with padi, such areas should be subject only to the quit-rent which is normally demanded of such land.

The Chinese member of the Committee disagrees with the proposals regarding padi cultivation on estates. He points out that the areas are generally much too scattered and that it would be difficult to induce estate labourers to plant rice on proper lines on land not belonging to them.

Further, the Chinese member points out that the sub-committee did not ask planters to give evidence and therefore, does not know their views on this question.

The question of mining and rice cultivation is given consideration. Investigations regarding reclaiming old mining land, on the best condition in which mined land should be left with a view to future padi cultivation, and the economics of removal of top soil before mining an area and its replacement after completion of mining are among the recommendations made in this connection.

Finally, consideration is given to possible methods of financing the recommendations contained in the Report, and the conclusion is reached that this might most fairly be achieved by a loan or series of loans, and in this connection the suggestion is made that enquiry might be made as to whether any measure of assistance would be forthcoming from the Colonial Development Fund.

The Report concludes :—

" We feel, that the situation is such at the present time as to render it imperative that steps should be taken on more vigorous lines than have hitherto been contemplated for the extension of the rice industry. We feel

that any increases in production that may result would be an additional insurance against the threat of shortage owing to failure of outside supplies and an alleviation of wants owing to the depreciation of markets for export staples. We think that, in these circumstances, any additional expenditure that may be required may properly be faced by the Government."

This is a most comprehensive report of which a review can give but a bare outline. No doubt it will be most carefully examined by the Governments of Malaya, but it is deserving also of the close study of the general public who cannot at this juncture be unaware of the importance of the subject and should feel that the responsibility is theirs as well as that of the Governments.

The fear has been expressed to one member of the Committee "that every one will give lip service to the report and make a few gestures and then let it slide." It is to be hoped, however, that this fear may not be realised, but that the Government and public opinion may jointly work towards the adoption of these recommendations.

D. H. G.

Tyre Consumption and Rubber Production.

The Rubber Division of the Department of Commerce, United States of America has recently published estimates of the annual consumption of tyres per car in the United States, basing the statistics on the number of cars in service and the production of tyres.

Since the United States possess the largest number of cars in service the results should be of general interest. According to these estimates, the annual replacement during the years 1910-1917 has been 6.5 to 7 tyres per car. After 1918 a marked decrease in this replacement figure has taken place, reaching a figure of about 2 tyres per car in 1929.

The following table gives the figures for each year from 1910 to 1920.

Year.	Tyres per car.	Year.	Tyres per car.
1910	7.84	1921	3.16
1911	6.64	1922	3.36
1912	6.48	1923	2.93
1913	6.50	1924	2.99
1914	6.65	1925	2.80
1915	6.59	1926	2.38
1916	6.63	1927	2.48
1917	7.26	1928	2.50
1918	5.88	1929	2.11
1919	5.01	1930	1.65 (provisional figures).
1920	3.65		

The reviewer and others who are acquainted with the notable advances made in tyre manufacture in relation especially to improved quality, have emphasized on various occasions the important bearing of these figures and facts in relation to consumption of raw rubber. It is only necessary to bear in mind the fact that about 70 to 75 per cent. of raw rubber is consumed in tyre and tube manufacture in order to realise the effect of this decrease in tyre consumption on the consumption of raw rubber.

Fortunately the large increase in output of cars during the period under review has helped to neutralize the position to some extent. These figures are also correlated with facts known to every car owner who has possessed a car during most of the period covered by the figures. Whereas formerly 5,000 miles per tyre was considered a good performance—at the present time no car owner is satisfied with less than 10,000 miles per tyre, while performances of 15,000 to 20,000 miles per tyre are common. Although it may be considered by some that these results are due to the improvement in roads, the higher speed at which cars are now generally operated balances to a considerable extent the effects of road improvements, since it is well known that higher speeds result in greater wear and tear due to friction. Higher speeds would not have such an effect on the "ideal" road surface which would be free from all irregularities, but fortunately for tyre consumption, even with modern improvements, our road surfaces are not yet "ideal."

It can be stated fairly emphatically that the results are due to modern improvements in the quality of tyres effected by physical and chemical research.

B. J. E.

Journal of the Rubber Research Institute of Malaya.

The Journal of the Rubber Research Institute of Malaya, Vol. II No. 4, April 1931, price 50 cents, contains the following articles:—

The Effect of certain Fungicides on the Vitality of Hevea Buds by R. P. N. Napper; Test Spraying Experiments on Young Rubber Plants by F. Beeley; The Output of Estate Sheeting Batteries by E. Rhodes and R. O. Bishop; and Manganese in Raw Rubber by R. O. Bishop and K. C. Sekar.

Miscellaneous Articles.

ENTOMOLOGICAL NOTES.

Second Quarter, 1931.

BY

G. H. CORBETT.

Copra.

In "Entomological Notes, First Quarter, 1931," attention was directed to the fact that a considerable reduction in damage caused by insects to copra before leaving estates could be effected if old rice sacks were rendered insect-free prior to filling them with copra. During the past quarter the writer, in company with Mr. F. C. Cooke (Assistant Chemist for Copra Research), visited several coconut estates to ascertain if copra was heavily infested with insects before leaving estates and, if so, if suggestions could be advanced whereby insects could be reduced .

The principal insects were :

1. *Carpophilus* sp., probably, *dimidiatus* (Nitidulid).
2. *Necrobia rufipes* F., the Copra beetle or "bug" (Clerid).
3. *Silvanus surinamensis* L., the Saw-toothed flour beetle (Cucujid).
4. *Silvanus advena* Waltl., (Cucujid).
5. *Tribolium castaneum* Hbst., the Red flour beetle (Tenebrionid) and
6. *Ephestia cautella* Walk., Flour moth (Pyralid).

Other insects were also found but were not so numerous.

The beetle, *Carpophilus* prob. *dimidiatus*, is about 3 mm. in length, brownish and with short wing covers. It was found on all estates but a considerable variation in the numbers was observed. The variation in the numbers of this beetle was in proportion to the amount of improperly dried copra. Where copra had been properly cured, this insect was practically absent. Observations have not been sufficiently extensive to make definite statements, but little doubt remains that if copra drying on some estates were accelerated, thereby preventing the development of moulds to which this insect would appear to be especially attracted, this beetle would not be so abundant in copra leaving estates as it is at present. It is interesting to record that on one estate this beetle was present on copra, which had developed moulds, on the edge of the drying kiln. Apparently this fact had been overlooked. The improperly dried copra was sorted and placed on a kiln in the sun for further drying. This beetle was present amongst this partially dried copra in enormous numbers. If this beetle should be present on estates, attention should be directed to ascertain, firstly, if drying requires to be accelerated and secondly, if copra is sufficiently dried before being removed from the kiln.

In a list of the insects found on copra on its arrival in England, this beetle is not recorded.

Necrobia rufipes F. is the well-known beetle which is frequently encountered on ships and referred to generally as the copra " bug ". The adult is about 5—8 mm. in length, bluish in colour with reddish coloured legs and antennae. This insect is generally considered to be predaceous but it has been successfully bred from egg to adult on insect-free copra.

This beetle was absent in some copra stores but present in others. The presence of this beetle was apparently entirely due to the fact that the empty sacks, which contained previous consignments of copra, were returned from ports. In no instance, where copra was shipped direct, (i.e. where no sacks were returned to the estate) was this insect observed. In one case, sacks which had just arrived from Singapore were found with this copra 'bug'. In this connection. it is interesting to record, as confirming the above statement, that the Manager of one estate remarked that sometime ago when his sacks were returned, he encountered considerable trouble from this beetle and was obliged to fumigate his store. Subsequently he shipped his copra direct to England with the result that *Necrobia* is now never seen in his store. It would therefore appear in order that copra should arrive *Necrobia* free at the country of importation, efforts should be made to control this beetle at ports or failing that, for copra to be exported direct. It is realised that this subject is a delicate one but it is doubtful if any change is procedure will occur until a better price obtains for insect-free copra.

Silvanus surinamensis L., *S. advena* Waltl., *Ephestia cautella* Walk. and *Tribolium castaneum* Hbst.

Silvanus surinamensis.—Saw-toothed flour beetle, is dark brown, elongated, about 3 mm. in length with teeth on lateral margins of first thoracic segment.

Silvanus advena, another Cucujid beetle, is about 2 mm. in length, brown with a tooth on anterior lateral margin of first thoracic segment.

Ephestia cautella—is a small moth, the caterpillar of which feeds on and spoils by webbing the appearance of copra.

Tribolium castaneum—is a reddish brown beetle, about 3.5 mm. in length, with clubbed antennae.

The above four insects are commonly associated with stored rice and since they, with other stored rice pests, feed on copra, the use of old rice sacks for the purpose of transporting copra is conducive to it becoming insect-ridden by the time it arrives at its destination. No precautions would appear to be taken to render these sacks insect-free with the result that the copra is immediately attacked. Indeed, unless a better price is obtainable for insect-free copra, the writer is unable to advance any particular reason (unless by so improving its appearance, the buyer will eventually realise that Malayan copra is comparatively free from insects and will pay a higher price) why extra expense should be incurred by so making it. Nevertheless, old rice sacks could be rendered free from insects without involving considerable expenditure by immersing the sacks in boiling water or in a solution of tuba root. In this

connection, it may be mentioned that the rice store is frequently within the copra store. This arrangement should not be countenanced, since copra in store is exposed to insects emerging from the rice in the rice store.

It is interesting to note that on some of these estates, the well-known rice weevil, *Diocalandra oryzae* L., was present, but no specimens of this weevil were collected from the copra.

In summing up these brief remarks, the return of sacks from ports would appear to be responsible for the presence of *Necrobia rufipes* on estates, the use of old rice sacks for the presence of the rice pests in copra, and improperly cured copra for damage by *Carpophilus* (?) *dimidiatus*. With ordinary precautions, and especially if copra were shipped direct, copra should not be so insect-ridden, as it is at present, on arriving at its destination.

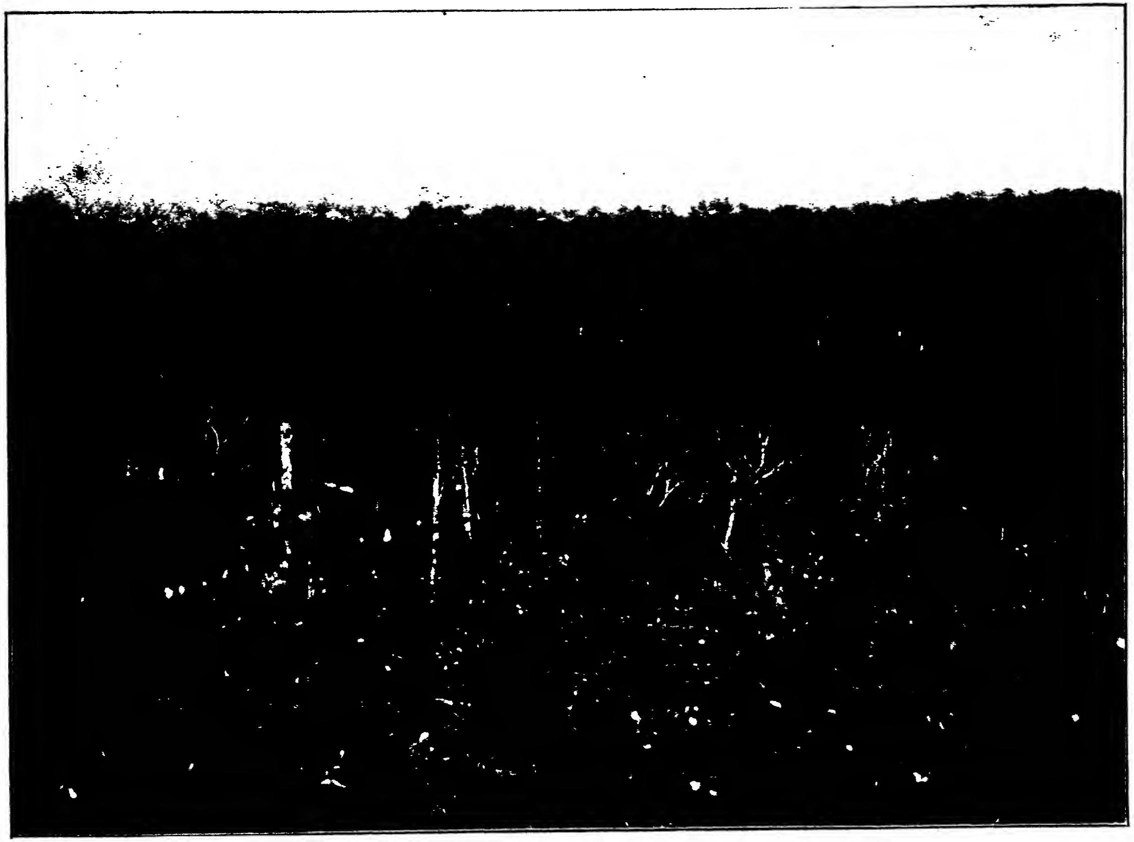
Shade Trees.

Some crops for their successful cultivation require shade which is provided by growing trees throwing shade of a varying intensity. It will be seen therefore that the establishment of a cover tree is as important as that of the crop and in considering the species of shade trees, those which are nearly related to the crop should be avoided, since pests of the one will probably be pests of the other. Equally important also is to ascertain if shade trees are liable to be severely defoliated by any particular pest, since subsequently, expense may be incurred by having to replace one shade-throwing tree for another.

One of the accompanying photographs illustrates the injury caused by an insect to *Albizzia* used as a shade tree. The particular insect responsible for the almost entire defoliation of *Albizzia* trees over some 30 acres was the "case-worm", *Clania variegata* Sn. "Case-worms" are the caterpillars of Psychid moths and some species are important pests to crops. The interesting feature of psychids is the absence of wings in the female; the male is winged. The spread of these insects is therefore not dependent on the female moth, but on the caterpillars. This distribution may be accomplished by the caterpillars suspending themselves by silken threads from the tree and being conveyed by the wind from one tree to another or by the caterpillars reaching the ground by their silken threads and crawling to a neighbouring tree. An examination of the area of *Albizzia* trees under consideration revealed the futility of recommending a poisonous spray owing to the fact that the trees had been so completely defoliated: instead, the employment of sticking bands, composed of castor oil and rosin, around the bases of the trees to prevent the caterpillars from re-ascending the trees was suggested with the result that the ascent of the caterpillars was stopped, as is shown in the other photograph.

Derris. (Tuba.)

Stored Derris roots have from time to time been reported as bored by beetles. During this quarter, two complaints have been received concerning the loss occasioned to 'tuba' in store by beetles. Not only is 'tuba' seriously affected



General View of Albizzia trees defoliated by "Case-worms".

CASE-WORMS PREVENTED FROM RE-ASCENDING ALBIZZIA TREES BY A STICKY BAND.

in Malaya, but consignments of Derris root exported from Malaya have been found to be heavily damaged by insects on arrival at their destination. The principal beetles feeding on 'tuba' root are *Sinoxylon anale* Lesne., *Sinoxylon malaccanum* Lesne., *Xylopsocus capucinus* F., *Dinoderus bifoveolatus* Woll., *Minthea rugicollis* F., *Hypothenemus eruditus* Westw. and *Bothrideres (?) andrewsi* Grouv. The first five beetles are Bostrychids, the sixth a Scolytid and the last a Colydiid.

Apart from the interesting fact that these beetles thrive on derris root, which is the source of the insecticide 'tuba' and enters into the composition of several derris insecticidal preparations, the questions of financial loss to the growers and of the heavily infested root on its arrival at its destination should be considered. Where derris is grown on a commercial scale and is stored for an indefinite time, fumigation and storage in air-tight receptacles should be undertaken. The aim should be to obtain an insect-free product on its arrival at the importing country, otherwise 'tuba' from Malaya may not command the best market price.

Coffee.

The discolouration of coffee seeds in otherwise healthy looking berries was reported from one estate. In the majority of cases one only of the two seeds showed this black discolouration, the other having developed normally. This discolouration of the seed was traced from the ripe to the just forming berry which indicated that the damage was inflicted to the young seeds when the coffee bush was in flower. The examination of coffee flowers revealed the presence of a thrips ((?) *Heliothrips haemorrhoidalis* Bouché.) which probably introduces a pathogenic organism, causing thereby the discolouration of the coffee seeds. Specimens of berries were submitted to Mr. A. Altson, Acting Mycologist. He failed to isolate any fungi or bacteria and suggested that the degeneration of the seed may be caused direct by insect punctures or by an insect introducing a pathogenic organism.

Tea.

No serious caterpillar pest of tea in lowland areas is known in Malaya. Tea at high altitudes would appear to be more subject to damage by caterpillars. The tea leaf-roller (*Gracilaria theivora* Wlsm.) was reported from Cameron Highlands causing serious damage to the younger leaves. The caterpillar of this moth at first mines the young leaf from the mid-rib to the edge. Subsequently, leaving the mine, it folds the leaf and feeds under cover of the rolled-up leaf. The control of this moth consists in cropping attacked leaves and all shoots ready for plucking, and burying or burning prunings.

The moth is about 6 mm. in length, the forewings are purplish brown with an orange coloured semicircular marking in the middle of the anterior margin

of the forewing. The caterpillar attains a length of about 10 mm. and is greenish white with a brownish coloured head.

Tea bushes in a certain area in the lowlands suffered from a "white ant", probably a species of *Microtermes*. Experiments have been laid down in order to find an effective control.

General.

"Bordeaux" mixture would appear to be regarded in some quarters as an insecticide and disappointment that it has failed to kill caterpillars has been experienced. Whilst Bordeaux mixture is an excellent fungicide, it is not an efficient insecticide. Lead arsenate at the rate of 2 lbs. to 50 gallons of water will effectively control most leaf-eating insects.

MEETING OF THE AGRICULTURAL ADVISORY COMMITTEE HELD ON JUNE 5th 1931.

A meeting of the Agricultural Advisory Committee was held on 5th June, 1931 at which the following members were present :—

The Director of Agriculture, Dr. H. A. Tempany (Chairman). The Director of Co-operation, Mr. A. Cavendish. The Director, Rubber Research Institute, Major B. J. Eaton.

Messrs : M. J. Kennaway, J. Melville, R. E. M. Michaux, G. S. Reis, W. A. Stanton and The Assistant to Director of Agriculture, Mr. W. N. C. Belgrave (Secretary).

The meeting was preceded by a visit of members of the Committee to Serdang Experimental Plantation on June 4th, when the School of Agriculture, the Stock Farm, planting nurseries and factories were inspected : in the evening of the same day the members attended a private view of the film recently prepared by the Department on the subject of Rice Cultivation.

At the meeting various subjects were discussed; these included :—

1. *Reorganisation Proposals for the Department.* The Governments of the Straits Settlements and Federated Malay States, had accepted the Director's scheme for reorganisation of the European and Asiatic staff of the Department, with some modifications and with the proviso that for the Federated Malay States the scheme for Asiatic Assistants should be confined to Malays, officers of other Asiatic nationalities being appointed *ad hoc* as necessity arose.

In relation to Chinese agriculture a small staff of Chinese Sub-Inspectors of Agriculture was also envisaged ; excellent relations had already been established with the large population of Chinese market gardeners in Selangor through the intermediary of the Chinese agricultural officer appointed three years ago.

It was anticipated that the construction of the new buildings and laboratories for the Agricultural Department would shortly commence.

The programme for the considerable extension of agricultural stations and test plots had been accepted by the Administrations concerned and satisfactory progress had been made with their establishment.

An officer of the Field Division had been seconded to Kelantan with a view to the improvement of agricultural conditions in that State.

2. *Work on Padi.* The standard manurial experiments for the season 1930—31 had, as a whole, not demonstrated satisfactory increases as a result of application of a variety of artificial fertilisers, although at Talang Experimental Station large increases were obtained on previously neglected land. Further experiments will be carried out in the season 1931—32.

Tested pedigree seed produced at the stations of the Agricultural Department would be on sale in the forthcoming season in every mukim of Krian, and it was hoped to extend this system throughout the country in subsequent seasons.

The present system of estimation of padi yields by guess work was unsatisfactory and various methods of estimation had been under test during the past season.

The results of last season's work on control of padi stem borer by liberation of egg-parasites on a large scale had been inconclusive; parasitisation and plant infestation had been found to decrease as a result of liberation of parasites but no clear evidence of increased yield had been obtained.

It is hoped to continue the experiments in the coming season.

3. *Work on Coconuts.* Unexpected difficulties had been encountered which had prevented the anticipated extension of the Coconut Experiment Station, Klang. It was hoped that these would be overcome before the end of the year.

The Assistant Chemist, Copra Research, had been deputed to pay a visit of one month to Ceylon to study methods of copra production there with a view to a better understanding of the premium gained by Ceylon over Malayan copra in European markets. A systematic investigation was to be made of the distribution of coconut roots in relation to drainage problems and loss of trees due to excessive leaning.

4. *Agricultural Work at Fraser's Hill.* The buildings for the dairy at Jeriau had been completed and progress made with the vegetable and poultry areas. It was intended to establish a depot at the Simpang for the sale of dairy products, vegetables and possibly flowers. A herd of high-grade cattle was on the way from South Africa.

5. *Rat Campaign.* The system of paying rewards for rat tails had been abandoned in Perak and Province Wellesley, as it was considered to have served its purpose of demonstrating the benefits of rat destruction. Guidance and assistance would continue to be given to cultivators in their war against rats.

6. *Progress at Cameron Highlands.* Tea-making machinery would shortly be installed and in the meantime the experimental manufacture of hand-made tea would be discontinued.

7. *Statistical Work.* The Deputy Registrar-General of Statistics has been seconded for a further period of one year as Statistician to the Department of Agriculture.

8. *Small Holdings.* A grant of $10,000/- from the Rubber Research and Experimental Fund had been approved for the carrying out of measurements of bark reserves and bark consumption on small holdings.

9. *Tobacco Growing.* With the co-operation of one of the large tobacco-growing corporations, experiments had been commenced with cigarette tobacco at the Government Experimental Stations.

Other subjects discussed were the projected Fertilisers Enactment, soil erosion, the annual report of the Department and the local tea industry.

In view of the Director's early departure on leave a resolution was passed expressing appreciation of the improvement and progress that had been made in every phase of agricultural work in this country since Dr. Tempany's arrival.

In reply, the Director attributed much of the progress accomplished to the unfailing and willing assistance of members of the Advisory Committee and of the planting community, both European and Asiatic, to the sympathetic attitude of the Governments, and to the co-operation of the staff of the Department.

Departmental.

FROM THE DISTRICTS.

The Weather.

Rainy weather with sufficient water for seasonal operations in connection with the padi crop is reported from everywhere. In a few instances the rainfall was in excess of requirements; thus, flooding of a newly transplanted area at Mantin, flooding of nurseries in Malacca (without permanent injury being done) and the holding up of work in Penang owing to several severe floods and too deep water is reported. In nearly every case rainfall figures given indicate a precipitation for the month well above the average. This does not apply to West Pahang where figures approximate to normal but judging from the figures from Pekan, the rainfall on the East Coast was well above the average.

Remarks on Crops.

Rubber.—Local prices ruling for the month differ little from those given for May, being from \$8—\$14 per pikul for smoked sheet, from \$7—\$11 for unsmoked sheet, from \$2—\$7 for scrap and from \$5—\$7 for lump. The somewhat large range of price for each article is due partly to variation in quality and partly to the situation of the locality as it affects internal transport costs. The general position as regards areas of small holdings out of tapping has not materially altered during the month. It is estimated that one third of the area under tappable trees in Bentong District (West Pahang) is out of tapping as the result of the low price of the commodity and activity in connection with padi planting in Malacca has resulted in a number of Malay holdings remaining out of tapping.

The wet weather experienced has resulted in general increased activity of the Mouldy Rot fungus but control has been fairly efficiently maintained in most localities.

Padi.—General activity in connection with this crop is reported from everywhere.

Fairly heavy infection of stem borer has been found as the result of the inspection of recently transplanted padi in Selangor whereas in Negri Sembilan the examination of eighty nurseries resulted in no trace of stem borer being found.

During the month 665 gantangs of pedigree padi were sold to cultivators in Perak, 464 in Malacca, 46 in Province Wellesley and 520 in Dindings. In addition 658 gantangs were supplied in Malacca to cultivators in Jasin district as a semi-experimental, semi-relief measure. The above does not include distribution in Krian district where orders for nearly 2,000 gantangs have been received and the distribution of this amount is in hand.

Coffee.—The local price hardened slightly during the month being approximately as follows:—

Perak Central	...	13—15 cents a kati	
„ South	...	14—18 „ „	
Selangor	...	12—14 „ „	Klang and Ulu Langat
..	...	10—11 „ „	Kuala Selangor and Kuala Langat
Negri Sembilan	...	10—17 „ „	
Pahang	...	11—12 dollars per pikul	—Temerloh.
„	...	16—20 „ „	Bentong.
„	...	13 „ „	Raub.
Kedah	...	23—28 „ „	(first quality.)
„	...	16—18 „ „	(second quality.)

The above table illustrates the great variation in price in different localities that was referred to last month.

Reports of the presence of the Coffee Berry Borer, *Cryphallus Hampei* have been received from various localities. Thus at Slim in Perak South the pest was found to be doing considerable damage; fresh areas at Port Dickson have been found to be infected and the pest is still paramount in Raub and Bentong districts of Pahang. Further survey of the position in Malacca revealed that although the pest is present in several localities the percentage of infection is low. The pest is also reported from Kulim in Kedah. An area that received treatment in Kuala Pilah (Negri Sembilan) by keeping all berries off the trees for six months was recently inspected. No trace of the pest could be found.

Tobacco.—The area under this crop is still extending in Province Wellesley and interest in the crop is maintained in the Degong area of Perak. In Province Wellesley a large amount of seed of a Rangoon type has been sown, the seed having been supplied by a local manufacturer. In Degong complaints have been received that cheroots made from local tobacco are inferior to those made from imported tobacco. This matter is receiving investigation. The experiments in Province Wellesley with insecticides against leaf eating caterpillars are being continued and some success is reported.

Field Crops.—The increased activity recently evinced in food crops continues to be maintained.

Notes on Agricultural and Padi Test Plots.

Perak.—At the Kuala Kangsar Station attention has been given to experiments with a number of varieties of tobacco and the curing of leaves of some of the earliest planted beds is in progress. Various minor crops are being grown, but the planting up of permanent crops awaits the coming season. Preliminary work on Selama station is well in hand. Details are complete regarding the varietal trials to be undertaken at Padi Test Plots in the coming season. It is anticipated and these trials will be made at the following centres, Lenggong,

Upper Perak; Bukit Gantang, Larut; Talang, Kuala Kangsar and Bruas, sub-district of Bruas. Manurial and cultivation experiments have been laid down at Talang and the cultivation trials at Selinsing are to be continued.

Selangor.—Transplanting is nearing completion on the Test Plot at Kuang. The use of the Kajang plot as a Padi Test Station has been discontinued and the area is to be used for training in connection with the School of Agriculture. Thirteen students spent three days at the plot transplanting seedlings.

Negri Sembilan.—Draining has received improvement on the Seremban Fruit nursery and manuring of the established fruit trees received attention. Felling and burning has been completed on the Rembau Agricultural Station site. The Rembau Padi Test Plot has been cultivated and a nursery area fenced off in preparation for sowing.

Pahang.—Agricultural Stations. Tobacco trials are being laid down. The maize and soya bean are doing well. Felling was completed in the Temerloh station site. Fencing of the Kuantan station is completed and draining work is in hand. At the Pekan station plots of maize, Guinea grass and yams were planted. A scheme is being drawn up to bring this station in line with the general plan of work governing other agricultural stations.

Padi Test Plots. Nurseries have been sown at the Raub Plot and planting has commenced at Temerloh and Pekan.

Malacca.—Clearing, except for the larger stumps, is complete at the Sungei Ledang Station and a skeleton staff only is employed until the planting season commences. Ploughing and harrowing has been done on the maintenance of Pulau Gadong Padi Station and nurseries have been sown. Nurseries have been sown at the Alor Gajah Padi Test Plot.

Province Wellesley.—Improvements to bunds have been completed at Glugor Test Plot. The inter-crop short season varieties of padi have suffered from flooding and rat damage. As the planted area is completely surrounded by a heavy growth of vegetation, on the land being fallowed between crops efficient control of rats on the planted area is a very difficult matter. Radin Siak appears at present to be the most promising of the inter-crop varieties tried. The new irrigation drain and dam at Bukit Merah Test Plot was completed by the middle of the month and is working satisfactorily.

Kedah.—Good rains enabled ploughing to be started under favourable conditions on the Telok Chengai Padi Station. The beneficial effect on the physical properties of the soil through allowing the straw to rot on the land instead of burning it is very marked and it enables deeper and quicker ploughing to be done. A series of manurial and cultivation trials have been laid down and plots have been marked off for these.

Rat Destruction.

The re-organisation of the control scheme in Krian and Province Wellesley has now been finished and work on the new basis has commenced.

DEPARTMENTAL NOTES.

The Director of Agriculture on Leave.

Dr. H. A. Tempany, Director of Agriculture has been granted 7 months and eighteen days' leave on full pay with effect from the 13th June, 1931.

Dr. Tempany will represent the Governments of the Federated Malay States and Straits Settlements at the first Conference of Directors of Agriculture to be held in London from the 14th to the 17th July, 1931.

The Federated Malay States Government has approved a proposal that Dr. Tempany should, during the period of his leave, visit the rice fields of Northern Italy and also certain Agricultural Institutions in England, with a view to studying rice planting on modern lines, and to keep in touch with recent developments in agriculture.

Mr. F. W. South, Chief Agricultural Field Officer assumed the duties of Acting Director of Agriculture from the date of Dr. Tempany's departure on leave.

Copra Research.

Mr. F. C. Cooke, Assistant Chemist for Copra Research sailed from Malaya on 16th June for Ceylon, where for a period of one month he will make a special study of the conditions in relation to copra manufacture in that Colony.

In view of the fact that Ceylon copra is considered superior to that prepared in Malaya and to the growing importance of the industry in the latter country, a close comparison of the methods of manufacture in the two countries has been found essential for the development of Mr. Cooke's investigations.

Vernacular Publications.

Warta Perusahaan Tanah— the quarterly Malay agricultural journal of the Department—Volume IX, No. 1 was published on April 24th.

It contains articles on budding of rubber; the School of Agriculture, Malaya; the preparation of rubber from the point of view of small-holders; tobacco cultivation; co-operative rubber societies; the clove and nutmeg industry; the coffee berry beetle borer and school gardening.

The growing demand for this publication has necessitated the printing this year of 5,500 copies per issue, an increase of 500 copies per issue over last year.

Four Malay leaflets have been published this year, with a total of over 75,000 copies. The subjects of these leaflets are Rat Destruction, Mouldy Rot disease of Rubber, Stem Borers of Padi and Tobacco Cultivation. In addition, a reprint of 5.000 copies of the leaflet on Soil Erosion has been published. A very steady demand from Malays for the leaflets has been maintained, in addition to which they have proved most useful in connection with the tours of the Rural Lecture Caravan.

The Chinese Agricultural Journal, Volume V No. 1 was published in March, the issue consisting of 5,000 copies. It contained articles on Pink Disease of

Rubber, How to improve Malayan Kampong Copra, Pineapple Bran, The Coffee Berry Borer, Tobacco Cultivation in Kedah, Mechanised Rice Cultivation in Southern Siam, The School of Agriculture and the Development of Imported Live Stock in the Tropics.

Tours of the Rural Lecture Caravan.

The Caravan made a tour in Malacca from 25th May to 6th June, 1931. The tour was supervised by the Agricultural Field Officer, Malacca and was under the immediate charge of Malay Officers of the Departments of Agriculture and Co-operation. Twelve centres were visited, at each of which the agricultural officer gave a lecture on padi cultivation which was assisted by a number of exhibits in the afternoon, while in the evening he gave a lecture on Mouldy Rot disease of rubber, illustrated by lantern slides.

The attendances at the afternoon sessions seldom exceeded 100, a poor figure when compared with the evening when an average of over 1,000 people gathered for the purpose mainly of viewing the Co-operative film. The lecturer was of opinion, however, that the afternoon sessions were more successful as the audience consisted of the more influential people; who could all see the exhibits, hear the lecturer and had a freer opportunity of asking questions.

The total attendances in Malacca exceeded 15,000 persons.

The Lecture Caravan commenced a tour in Province Wellesley and Penang on 20th June which will continue till July 2nd, 1931. The equipment on this tour will include for the first time a film, prepared by the Department of Agriculture entitled "Rezeki" which deals with the necessity of increasing the local cultivation of padi and the means whereby larger yields of better quality padi may be obtained.

Stock for Dairy Farm Fraser's Hill.

Twenty six heifers and one young bull of the Friesian breed have been imported by the Department from South Africa. They arrived in Singapore on 27th June and were transported by railway and lorry to the Government Stock Farm, Jeriau, Fraser's Hill where they arrived in good condition the next day.

One calf was calved during the voyage and one calved within twelve hours of arrival at Fraser's Hill. The calves are in good condition which is evidence of the good health of the stock maintained throughout the voyage of about one month.

The Selangor Gardening Society Visits Serdang.

The Selangor Gardening Society visited the Government Experimental Plantation, Serdang on 29th June, 12 members being present, including Sir Lancelot Elphinstone, Chief Justice F. M. S., who is President of the Society.

The opportunity was taken on this occasion to show the visitors the work being conducted with the cultivation of food crops.

Leave.

Mr. J. Gordon-Carrie, Statistician and Deputy Registrar-General of Statistics has been granted 8 months and 25 days' leave on full pay with effect from the 27th June, 1931.

Mr. J. A. Craig, Principal Agricultural Officer, Kelantan, has been granted 7 months and 10 days' leave on full pay with effect from the 28th June, 1931.

Staff Changes.

Mr. D. H. Grist, Agricultural Economist, to act as Statistician and Deputy Registrar-General of Statistics in addition to his own duties from 27th June, 1931.

Mr. F. Birkinshaw, Agricultural Field Officer, Perak North to act as Chief Field Officer from 12th June, 1931.

Mr. A. E. Coleman Doscas, Agricultural Field Officer, Selangor to act as Agricultural Field Officer Perak North from 12th June, 1931.

Raja Mohamed bin Raja Aman to act as Agricultural Field Officer, Selangor from 12th June, 1931.

Statistical.

MARKET PRICES.

June, 1931.

The American moratorium proposals have affected local Produce Markets and prices for most articles show some advance.

Rubber.—Until the last three days of the month, when the local price of rubber appreciated by about half a cent per lb., the rubber market has been quiet, the spot price of RSS equal to London Standard being about 9½ cents per lb. The average Singapore price for the month was 9.5 cents per lb. compared with 9.1 cents in May. The average London price was 3d per lb. as in May.

Palm Oil.—The May London prices for palm oil were very disappointing. A London correspondent, writing on 14th May stated that the value was £15.10.0 to £16 C.I.F. (£10.10.0 to £11 F.O.B.) according to F.F.A. content at origin and by May 21st the price had further declined by about 10 shillings per ton.

Copra.—Prices were at their lowest ebb at the beginning of the month with the price around $3.80 per picul but a sharp reaction took place, due in part to the demand of the local Oil Mills, which culminated at the end of the month at $5 per picul. The average price on the Singapore market for "Sundried" was $4.23 per picul, compared with $4.80 in May. For the "Mixed" quality, the average price was $3.99 compared with $4.59 in May. Copra cake was steady at $1.75 per picul.

Gambier.—The price of No. 1 Cube gambier has remained steady at $15 per picul. Block gambier declined from $11 to $8.75 per picul, the average for the month being $9.68 compared with $11.21 in May.

Rice.—All grades of imported rice experienced a fall in prices during the month, reaching the lowest point about 17th May and thereafter recovering somewhat. Average Singapore prices per coyan for June were: Siam No. 1 $138, Saigon No. 1 $131, Rangoon No. 1 $119, compared with $157, $135 and $126 for the previous month.

Arecanuts.—Prices for most grades improved slightly during the latter part of the month. Average prices per picul for the various grades were: Palembang Whole $3.82; Bila, Whole, $3.50, compared with $4.81 and $3.94 respectively in May. For other grades, the average prices ranged as follows:- Sliced $6.12 to $13; Red Whole, $5.37 to $6.40; Split $3.57 to $4.90; Kelantan Split $5.40 to $5.81, the price within each range depending on quality.

Coffee.—Prices have been fairly well maintained and are said to be firm in Java. The price per picul of Java Robusta averaged $16.87 to $18.94 the price within the range depending on quality. Palembang coffee averaged $12.87 per picul.

Pineapples.—Supplies of fresh fruit continue to be short and higher prices have been paid. The average prices per case for June were:- 1½ lb. cubes $3.50,

$1\frac{1}{2}$ lb. sliced flat \$3.36, $1\frac{1}{2}$ lb. sliced tall \$3.57, compared with the following corresponding prices for May \$3.20, \$3.09, \$3.37.

Tapioca.—The market has been quiet. Average prices per picul were :- Flake fair \$3.19; Pearl, seed \$4.19; Pearl, medium \$4.90 compared with \$3.32, \$4.50 and \$5 respectively in May.

Sago.—Market was poor for the greater part of the month, but a moderate advance took place during the last week. Average prices per picul were for Pearl, small fair \$4.45; Flour, Sarawak fair \$1.78 compared with \$4.50 and \$1.93 respectively in May.

Pepper.—Prices improved at the end of June, but it is thought that the demand is largely speculative. Singapore black averaged \$18.12 per picul compared with \$18.44 in May; Singapore, white \$29.75 against \$32.20 in May; Muntok, white \$30.75 compared with \$33.68 for the previous month.

Cloves.—Zanzibar cloves have remained steady at \$52 and Amboina at \$56 per picul. Average prices for May were \$54.40 and \$56 respectively.

Mace.—Average Singapore prices per picul in June were: Siouw \$51.75; Amboina \$38.12. Corresponding prices in May were \$56 and \$43.

Nutmegs.—Supplies are short and an improved demand from Germany resulted in an all round advance in prices at the end of the month. Average prices per picul for June were for 110's \$20; 80's \$26, compared with \$19.50 and \$25.70 per picul in May.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in April and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd., and reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore.

1 picul = $133\frac{1}{3}$ lbs. ... ... 1 Coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MAY 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	12,864	12,583	11,142	56,167	7,982	43,282	Nil	Nil	Nil	26	12,481	6,521	66,371	35,191	12,296	13,273	...
Johore	...	2,228	4,372	3,460	17,474	3,569	19,698	Nil	2	Nil	9	817	6,504	3,634	34,083	2,315	3,995	...
Kedah	...	432	2,051	2,065	9,996	1,023	5,249	Nil	Nil	Nil	Nil	608	2,399	3,110	12,620	416	2,148	...
Perlis	...	10	9	11	39	2	53	Nil	Nil	Nil	Nil	Nil	18	Nil	99	9	5	...
Kelantan ...	...	108	102	204	982	356	1,994	3	Nil	12	Nil	46	470	347	2,595	179	78	...
Trengganu ...	..	55	50	94	467	47	233	Nil	Nil	Nil	Nil	Nil	141	Nil	700	55	50	...
Total Malay States	...	15,697	19,167	16,976	85,125	12,979	70 509	3	2	12	35	13,952	16,053	73,462	85,288	15,270	19,549	...
STRAITS SETTLEMENTS																		
Malacca ...	...	2,795	1,364	1,195	5,773			Nil		Nil		4,282		24,547		2,878	1,375	...
Province Wellesley	...	126	458	461	2,118	(2)	(2)	Nil		Nil						151	532	...
Dindings ...	...	171	80	93	456	2,420	10,537	Nil	16,051	Nil	85,253	6,430	Nil	31,317	Nil	94	92	...
Penang	1,630	4,986	5	8	37			586		3,703						4,476	9	1,025
Singapore ...	1,771	33,378	332	171	918			7,930		39,654		19,617		100,427		32,470	344	2,118
Total Straits Settlements	3,401	41,456	2,239	1,928	9,302	2,420	10,537	8,516	16,051	43,357	85,253	30,329	Nil	146,291	Nil	40,069	2,352	3,143
TOTAL MALAYA	3,401	57,153	21,406	18,904	94,427	15,399	81,046	8,519	16,053	43,369	85,288	44,281	16,053	219,755	85,288	55,339	21,901	3,143

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	9,426	18,997	2,809	2,006	769	34,007
Crepe	650	11,599	1,077	743	399	14,468
Unsmoked sheet	1,190	1,874	590	374	777	6,205
Scrap and lump	1,030				370	
Total all Grades	12,296	32,470	4,476	3,123	2,315	54,680

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	29,202	142259
Penang ...	10,403	51,012
Port Swettenham.	4,225	23,690
Malacca ...	451	2,792
MALAYA ...	44,281	219753

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	35,979	176775
MALAYA ...	35,979	176775

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i. e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] estimated—[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, the figure represents purchases by dealers from local estates of less than 100 acres during the month.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics S.S. and F.M.S., at Singapore on 19th June, 1931.

GENERAL RICE SUMMARY.

May, 1931.

Malaya.—Harvesting was completed in the principal rice growing areas of Perak. In the Krian area 92 per cent. of the padi land was planted, the crop averaging 336 gantangs per acre. The gross crop was 16,482,950 gantangs. Malacca harvests are complete. The crops were good in the Central and Alor Gajah Districts, but poor in the Jasin District.

In Perlis, Negri Sembilan, Selangor and Pahang the preliminary work of cultivation and sowing nurseries is in progress.

The average monthly import of rice into Malaya in 1931 is 44,000 tons compared with 50,000 tons per month in 1930. The average retail price of No. 2 Siam rice in Singapore during May was 32 cents per gantang, compared with 33 cents for the previous month and 50 cents for 1930.

The stocks of rice for the end of April held by wholesalers and retailers in Malaya were estimated to be 47,000 tons.

India.—Total foreign exports of milled rice (as reported by the *Indian Trade Journal* of May 14, 1931) during the first quarter of 1931 amounted to 536,000 tons, compared with 881,000 tons for the same period of 1930.

According to the *Bangkok Times* (May 29, 1931) the Burma export of rice and rice products from January 1st, to May 16th, 1931, was 1,613,000 tons compared with 1,982,526 tons for the same period of the previous year, or a decrease of 17.8 per cent.

Japan.—According to the Ministry of Agriculture and Forestry, stocks of rice in Japan (Proper) on May 1st, the first day of the second half of the present rice-year, amounted to 5,054,688 tons, an increase of 13.1 per cent. compared with the same period last year.

The demand and supply of rice for the second half year, based on the stocks on May 1st, shews surplus assets of 1,731,000 tons of rice. Of this amount, it is estimated that 1,020,000 tons will be this year's surplus carry-over.

Netherlands East Indies.—The area planted with wet rice is practically the same as in 1930. Dry padi land planted this year shews a decrease of about 5 per cent.

The imports into N. E. I. during the first quarter of 1931 were 185,000 tons, being a decrease of 81,000 tons compared with 1930.

Ceylon.—Imports of rice into Ceylon, January to April inclusive, were 149,095 tons against 169,998 tons for the same period in 1930.

Europe.—According to the London Rice Brokers' Association weekly Circular dated May 7th, 1931, the quantities of rice shipped from the East during the period January 1st. to May 7th, was 312,000 tons being an increase of 5.8 per cent. on that for the corresponding period of 1930.

The shipments to the West Indies and America for the first quarter of 1931 were 47,000 tons an average decrease of 28.8 per cent. on that for the corresponding period in 1930.

METEOROLOGICAL SUMMARY, MALAYA. MAY, 1931.

Locality	Air Temperature in Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet	Total		Most in a day Amt.	Precipitation* .01 in or more.	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	92.5	74.4	83.5	96	72	88	77	85.9	86.0	8.64	219.5	2.58	16	12	4	2		213.80	6.90	56
Bukit Jeram, Selangor ...	90.1	74.3	82.2	92	72	87	77	85.9	87.6	20.07	509.8	10.98	19	16	2			232.30	7.49	61
Sitiawan, Perak ...	91.3	74.9	83.1	95	73	85	78	86.5	85.9	3.12	79.3	1.37	13	10	4	1		229.00	7.39	
Kroh, Perak ...	88.0	71.9	79.9	93	69	83	75	83.9	84.1	9.53	242.1	4.52	19	15	1	2		198.65	6.41	
Temerloh, Pahang ...	92.1	73.8	82.9	94	71	83	77	87.1	87.6	5.15	130.8	1.12	16	11	5	7		217.85	7.03	57
Kuala Lipis, Pahang ...	91.1	72.9	82.0	95	70	87	76	84.9	85.5	12.18	309.4	2.16	19	18	22	22	3	200.45	6.47	53
Kuala Pahang, Pahang ...	89.0	75.4	82.2	93	73	81	78	86.0	86.3	2.56	65.0	0.49	19	11	9			219.90	7.09	58
Mount Faber, Singapore ...	88.8	76.5	82.6	94	72	82	80	83.7	84.1	6.96	176.8	1.95	15	15	2			191.30	6.71	51
Butterworth, Province Wellesley ...	89.3	76.5	82.9	92	73	85	79	86.8	86.7	8.14	206.8	3.62	17	10				228.45	7.37	
Bukit China, Malacca ...	86.3	75.0	80.6	90	72	83	77	84.1	85.0	12.59	319.8	2.15	18	15	5			208.95	6.74	55
Kluang, Johore ...	89.8	73.6	81.7	94	70	82	76	83.7	83.7	6.86	174.6	2.24	16	13	3	7		184.10	5.94	49
Bukit Lalang, Mersing, Johore	90.1	73.8	81.9	92	72	81	76	83.9	83.5	9.42	239.3	2.00	16	13	1			208.40	6.72	55
Alor Star, Kedah ...	90.2	75.2	82.7	95	73	81	78	87.9	87.7	4.70	119.4	1.38	17	15				221.60	7.15	58
Kota Bahru, Kelantan ...	92.2	75.5	83.9	96	72	88	78	86.0	86.0	5.68	144.3	2.30	11	7				203.10	6.55	53
Kuala Trengganu, Trengganu	90.6	74.5	82.5	94	72	85	77	86.2	86.8	3.57	90.7	1.22	9	7	7			239.35	7.72	63
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	73.9	61.2	67.5	78	58	69	63			9.43	239.5	1.60	19	18		2		177.85	5.74	47
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	74.6	58.9	66.7	77	54	71	63	72.2	70.6	9.16	232.7	1.40	20	17		1		169.35	5.46	44
Fraser's Hill, Pahang 4268 ft.	75.8	63.6	69.7	79	61	72	66	73.4	73.8	15.48	393.2	3.34	24	21	9	18	1	177.35	5.72	47

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE

Malayan Agricultural Journal.

Vol. XIX. AUGUST, 1931. No. 8

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The Director of Co-operation.
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THE

Malayan Agricultural Journal.

AUGUST, 1931.

EDITORIAL.

The Employment of Trained Asiatics.

In his speech at the opening of the School of Agriculture, Malaya, the Director of Agriculture stated that while the School was founded primarily for the training of Asiatics for the Government agricultural services, the more important direct purpose of the School is that of creating a class of trained men who can be employed as assistants on estates or on the working of their own properties.

A few days after publicity was given to the above-mentioned speech, the Department received the first practical gesture of approval of the aims of the School.

The well-known Agency firm of Socfin Co. Ltd., who are widely interested in both rubber and oil palm properties in Malaya, in a recent letter state their conviction that the School will prove most useful for the Planting Industry which is in great need of qualified Conductors. The letter continues:—

> "We are in full agreement with you that eventual pupils of the Serdang School are to be encouraged by some prospect of future employment and, while we realise the precious support resulting of the posts offered by Government, we are of the opinion that Planting Companies should encourage pupils to join the School by giving them the assurance that they can eventually be employed by them.
>
> "We are pleased to inform you that—we are prepared to employ two of the first lot of men who will be qualified by Serdang School after three years course, and give them suitable jobs in our Technical Department and/or Estates.
>
> "We shall furthermore, each year, until 1940 at least, offer a post on our staff to one qualified pupil of Serdang School.....................
>
> "We sincerely hope that our proposition will decide other Companies to join us."

The support of this firm is a stimulus to our endeavours to create a nucleus of Asiatics with a more scientific knowledge of local agriculture, and we at this juncture re-iterate the hopes of our correspondent that similar support may be forthcoming from other sources.

Carp Rearing. Although Chinese carp ponds are a familiar feature in all parts of Malaya, yet we must confess that we saw no obvious connection between this industry and agriculture until the Fisheries Department drew our attention to the value of carp rearing as an adjunct to native agriculture.

Closer consideration of this subject has convinced us that not only may fish rearing prove a valuable asset to the agriculturist, but that the Department of Agriculture possesses the facilities and knowledge to extend and render more remunerative the carp rearing industry in Malaya.

Arising from our co-operation with the Fisheries Department on this subject, Mr. W. Birtwistle, Office-in-Charge Fisheries Department, S.S. and F.M.S. has, at our request, prepared an account of carp rearing which we publish in this number. The article will serve as a basis for further investigations into this subject by the two departments concerned.

It comes as a surprise to learn that these fish are vegetable feeders. The fact that the fish are reared and eaten by very strict Mohamedans in Singapore who would not countenance a suspicion of foul feeding is sufficient guarantee that carp rearing may be developed amongst all classes of the community.

The provision of suitable and adequate food for the fish presents no difficulties and in this direction the Department of Agriculture has already rendered assistance to the Chinese who are engaged in rearing this fish.

The Department of Agriculture suggested that Guinea grass would be a suitable food for the fish. Mr. Birtwistle has now established a supply of this grass and since the preparation of his article has written to state that the fish have decided to eat nothing but Guinea grass and discard all other kinds now. Moreover they have put on weight to a very marked extent.

A difficulty hitherto has been in the transport of the carp from China to Malaya and the subsequent distribution of the fry. The continued introduction of fry is rendered necessary by the fact that, apparently, these species of fish do not breed in this country. The primitive methods adopted in transporting the fry and the enormous wastage entailed thereby renders the retail price charged for the fry rather high—from \$3—\$5 per 100. Mr. Birtwistle states that he is now getting excellent results by delivery of the fry in hermetically sealed cans furnished with a supply of pure oxygen. The development of this aspect of the industry will go far to encourage an extention of carp rearing in Malaya by making the industry more attractive from a financial point of view.

Pineapple Propaganda. A new departure in advertising Malayan canned pineapples has been adopted by the Malayan Information Agency in the production of a film to demonstrate the use of Malayan pineapples in the preparation of various dishes.

The film proved to be most interesting and within a few days of its

production it was booked by 31 public cinemas, while further extensive bookings are anticipated.

It is considered that the continued propaganda of Malayan pineapples is proving a factor of considerable importance in the further development of this important local industry.

While prices in 1931 have continued at a low level in sympathy with almost all products, it is noted that the Malayan exports of canned pineapples for the first five months of 1931 amounted to 27,166 tons, valued at $3,320,741, compared with 26,159 tons, valued at $3,620,880 for the corresponding period of 1930.

The Malayan Exhibition. The eighth Malayan Exhibition may now be viewed in retrospect and many will be prompted to ask whether the event has fulfilled the functions for which it was designed.

We are of opinion that it has served to demonstrate to the small-holder the improvement he might effect in his crops by the employment of better seed and more careful cultivation, and it continues to encourage the village industries which are such an important adjunct to native agriculture.

The stock sections, and in particular the pig section, has undoubtedly impressed the Chinese who were here able to compare the local pig with imported and good cross breeds.

The Exhibition has given the planter an opportunity of getting into personal touch with the officers of the Rubber Research Institute and the Department of Agriculture and has also enabled him to meet the representatives of firms that are intimately connected with the planting industry.

Finally, no less than six Government departments embraced this opportunity of furthering educative propaganda work by staging comprehensive exhibits.

Whatever the financial result may be, the Malayan Agri-Horticultural Association may be assured that they have attained their object and the fact that the Exhibition was held during a time of severe trade depression only serves to emphasise the usefulness of their efforts in directing attention to methods of improving production and thus rendering agriculture more remunerative.

Original Articles.

REARING OF CARP IN PONDS

BY

W. Birtwistle,

Officer-in-charge, Fisheries Department, S.S. & F.M.S.

The rearing of carp is probably one of the oldest industries in the world, and it is highly probable that the Chinese were the first to raise it to the level of an established industry.

Radcliffe in his "Fishing from the Earliest Times" quotes from W. C. W. Yen's address before the Fourth International Fishery Congress, Washington in 1908, who stated that the earliest pisciculturist of ancient China was Tao Chu Kung, who lived in the 5th Century, B.C.

The same author points out that the Chinese did not practise artificial fertilisation i.e. stripping the male and female fish of their reproductive products and mixing them in water contained in some suitable container. This is a very modern development of pisciculture. The Chinese contend that this unnatural method produces a stock of fish which is not sound and they rely on fish hatched from ova which have been fertilised under natural conditions. That they are right cannot be denied, and it is only one indication of the high development of their technique of carp rearing. Their infinite patience, attention to detail, and great powers of observation, however, are the main factors of their success.

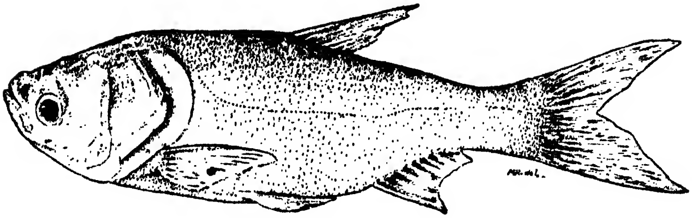
Kinds of Fish Cultivated.

There are five species of carp cultivated in Malaya, viz. (1) *Ctenopharyngodon idellus* (2) *Hypophthalmichthys molitrix* (3) *Hypophthalmichthys nobilis* (4) *Cyprinus carpio* (5) *Cyprinus* (sp. ?). With the exception of the Common Carp (*Cyprinus carpio*) all are imported from China as fry and reared in nursery ponds until they attain a size at which they can be placed in larger ponds and safely left to fend for themselves. The Common Carp will breed in Malaya and is the only one of the five kinds which will do so and it is therefore not necessary to import its fry each season. There is no record of any of the others ever having been found in a gravid condition, but it should be borne in mind that they are invariably eaten long before they have a chance to attain sexual maturity, and an open mind should therefore be kept with regard to this.

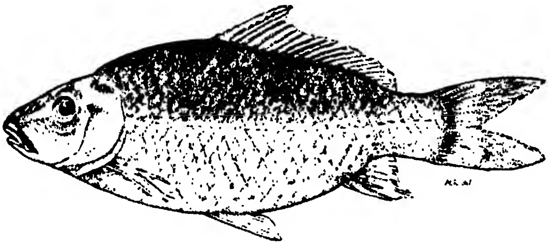
They are all either purely vegetable or silt feeders. *Ctenopharyngodon idellus* is known to the Chinese as Chow Hu the grass (eating) fish, and it lives up to its name since it feeds exclusively on grass and will consume a prodigious amount daily.

H. molitrix and *H. nobilis* are distinctly interesting and are remarkable links in the chain of economy of a carp farm. The Chinese names for these fish are Pey Lin and Twa Tow which mean "White Fish" and "Big Head",

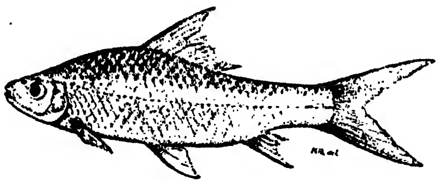
CARP.



HYPOPHTHALMICHTHYS NOBILI "Big head." (Quarter natural size.)
Cantonese: Tye Tow Yue. Hokien: Two Thow Song.
Grows to 4—5 lbs. in a year.

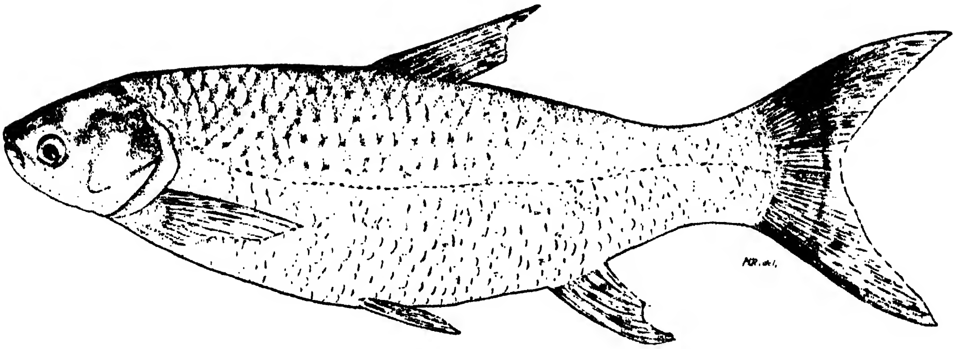


CYPRINUS CARPIO. The Common Carp. (Quarter natural size.)
Cantonese: Li Yue. Hokien: Li Koh.
Grows to about 3 lbs. in a year.

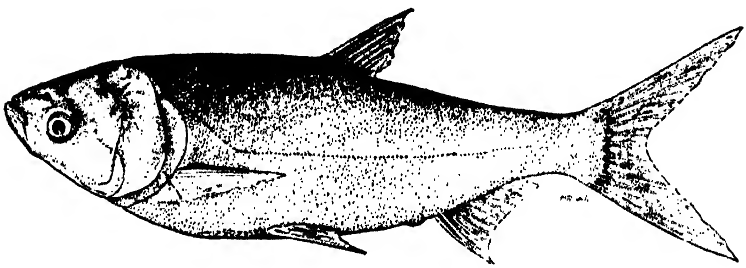


CYPRINUS Sp. (Quarter natural size.)
Cantonese: Tho Leng Yue. Hokien: Leng Chee.
Grows to less than 1½ lbs. in a year.

CARP.



CTENOPHARYNGODON IDELLUS "Grass eater." (Quarter natural size.)
Cantonese: Wan Yue. Hokien: Chow Hu.
Grows to 4—5 lbs. in a year.



HYPOPHTHALMICHTHYS MOLITRIX. (Quarter natural size.)
Cantonese: Pin Yue. Hokien: Peh Leng.
Grows to 4—5 lbs. in a year.

Their main source of food is the faeces consisting of half digested grass voided by Chow Hu—the grass fish. They supplement this by a diet of the rich organic silt from the bottom of the pond. The Common Carp and the other (unnamed) Cyprinid are known respectively in Chinese as Lee Ko and Leng Chee—the English equivalents of the latter are not known. They too, live on organic silt and any small animals and vegetation which may be available. The Common carp, however, thrives on an introduced diet of pea nut cake and, if this can be afforded, it is invariably placed in the water in a basket suspended from a horizontal pole.

Methods of Singapore Fish Culturists.

The cultivator aims at selling his stock within a year, and the fish are usually sold for some festival—Chinese New Year in February being a favourite season. He will then re-stock after cleaning out his ponds and destroying all the predatory fish which manage to find their way there into. He buys his stock from dealers in Singapore who are specialists in rearing the newly imported fry in nursery ponds for stocking purposes.

Food Value of Carp.

The flesh of all species is excellent and liked by the Chinese. There is a danger of a fish which has been raised in a muddy pond acquiring a muddy flavour, and for this reason a pond with a sandy bottom is preferred. The flesh is not only nutritious but very easily digested.

Fat accumulates in great quantities round the intestines and for this reason the fish are doubly prized by the Chinese.

As stated previously, carp breeding is not practised in Malaya. The carp fry is imported from China for stocking the ponds in this country.*

Local Transport of Fry.

Some experimental work has been done in Malaya on the transport of fry with a view to reducing the heavy overhead charges involved in carrying them in bulky tubs and in providing the necessary attendants. The results have been most interesting and follow a method described in Document No. 1045 published by the U.S.A. Bureau of Fisheries, which recommends the use of oxygen as an aid to transport of fishes.

On two occasions consignments, each of 50 fish of common carp fry about 2 inches long, were sent in an hermetically sealed and locked 4½ gallons aluminium

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* The capture of the carp fry in China and its transport to various countries where carp rearing is practised will form the subject of an article in the next issue of the *Malayan Agricultural Journal*.

container, and delivered after a journey of 26 hours with the loss of two fish only in one consignment. The container was completely filled with water and the fish were put in. The lid was then sealed and one-third of the volume of water was displaced by pure oxygen, which rested as a layer on the water at only just a little above atmospheric pressure. The container was put on rail as ordinary freight and delivered to the owner who used the fish for stocking purposes. On another occasion three Hypophthalmichthys weighing about 1 lb. each were placed in a similar container and left for 30 hours at the termination of which they were found to be in a perfectly healthy condition. The container was sealed and a fresh supply of oxygen blown in and they kept for another 16 hours and seemed to be quite healthy.

A consignment of 300 common carp fry about ¾ inch long sent on a 24 hours journey by train as ordinary freight in a container furnished with oxygen arrived in excellent condition without casualty. The last part of the journey—40 miles—was made by motor car.

The cost of transport for one container in the case of the two lots of fry plus the return of the empty container amounted to $4. Under the old method it would have meant two men's return fares, costing $21 for fares alone in addition to their pay and food.

The experiment was not carried out on a larger scale owing to lack of staff and to the fact that the fry season was nearly over, but it is intended to repeat the experiment later under actual trade conditions.

Food of Fry and their Growth.

The ponds in which the fry are placed after leaving the ship are, as a rule, small and care must be taken not to overcrowd. A pond 30 feet x 20 feet x 1¼ feet deep would accommodate about 2,000 fry ranging from 1 to 1¼ inches in length. Australian flour is shaken out of a coarsely woven bag on the surface of the water twice daily, morning and evening. *Ctenopharyngodon idellus* (Chow Hu) will eat in addition a considerable amount of vegetable matter, provided it is in a sufficiently fine condition, and will gorge themselves on the fronds of *Wolffia arrhiza*, a species of duckweed which is cultivated specially as fish food. E. J. H. Corner in the *Hong Kong Naturalist*, (Vol. 1 No. 2) describes the fronds as "minute oval bodies from ½ to ¾ millimetre long, rootless, and so firm as to feel gritty between the fingers." They float on the surface of the water in dense masses and form a scum, being devoured by the small Ctenopharyngodon fry which swim just beneath the surface of the water gulping in as many as they can. The supply must be replenished when necessary. The two Hypophthalmichthys, however, will only take the flour and the rich organic silt on the sides and bottom of the ponds, whilst the Common Carp and the other Cyprinid, if present, will devour in addition the entomostracans, copepods, rotifers etc. which abound there,

Growth is very rapid and within a fortnight the fish must be transferred to a larger pond. By this time they will have attained a length of between 2 and 3 inches. The two *Hypophthalmichthys* are the largest, *Ctenopharyngodon* next, followed by the Common Carp and the other Cyprinid, if these two latter are present. The food ration is now augmented, and in addition to Wolffia large quantities of duckweed (*Laemmia paucicostata* and *Spirodela polyrrhiza*) are introduced, primarily for the benefit of the grass fish fry which devour it greedily. A highly nitrogenous food such as peanut cake is also introduced and is suspended in a flat basket tray about a foot from the bottom of the pond. The basket is suspended at three points and attached to a cord hung from the end of a pole held over the pond. One cake is laid in the basket at a time and is renewed when necessary. The cake is the residue of peanuts from which most of the oil has been expressed. It is quite cheap and is exported from China in the form of circular flat cakes about a foot in diameter and ¾ inch in thickness. It softens in water and slowly disintegrates into fine particles and falls through the basket to the bottom of the pond. This is an excellent forcing food and is eaten and evidently enjoyed by all species of carp. As much of the cake is put in the pond as the fish will eat. It keeps sweet indefinitely. The fish are retained in the pond until they have attained a length of about 6 or 7 inches, which is a suitable size for sale and stocking, since they are now too big to be eaten by predatory fish. Furthermore, the Ctenopharyngodon can now chew grass and the problem of feeding is not difficult. Any grass which is not too hard appears to be suitable for this purpose. The succulent grass which grows in all wet places is an excellent feed; even lawn mowings will be eaten greedily but the fish will not eat "lalang grass" (*Imperata arundinaceae* Cyrillo. and *I. exaltata* Brongn.).

When the fish have attained a length of 6 or 7 inches they may be placed in a large pond say 100 feet x 50 feet x 3½ feet deep. Such a pond is suitable for 600 to 700 fish of this size. Care must be taken to stock the pond with the correct proportions of the five varieties of carp. It is generally estimated that 50 per cent. of the stock should be *Ctenopharyngodon idellus*, 20 per cent. of *H. nobilis*, 10 per cent. *H. molitrix*, 10 per cent. *Cyprinus carpio*, and 10 per cent. of the *Cyprinid* sp. The two latter species may be omitted, as they are included merely to provide a little extra profit. They do not attain to anything like the weight of the other three species in the same time.

Preparation of the Pond.

It frequently happens that a site may be secured which by taking advantage of natural features is made into an excellent fish pond with no expense other than the construction of a small embankment and a simple sluice gate.

Holes already dug and in many cases filled with water in the abandoned tin mining areas are very suitable. The ground is usually sandy and eminently

suitable for carp rearing and capable of giving high yields of fish. The development of such areas would not only prove profitable but would reduce the incidence of mosquitoes.

A further important factor in fish pond construction is to keep the sides free from overhanging or marginal weeds.

If the pond is to be planked on the sides, the sides should slope back, say at an angle of 15°—20°, and be faced with cheap timber planks 16 feet long x 8 inches wide x ¾ inch thick. The planks are held in place by 3 inch square stakes which are fixed about every 4 feet apart. They are driven into the ground at the same angle as the slope of the sides of the pond and hold the planks flat against the sloped side. Some ponds are dug in ground sufficiently firm not to need side supports of this kind, but they will require attention to prevent the banks from becoming undermined. The tops and sides should be kept free from overhanging weeds as an anti-mosquito measure.

Before the fish are introduced, care should be taken to ascertain that the water is not acid as may be the case in a newly constructed pond. This always happens when a pond is dug on land reclaimed from old mangrove swamp, which seems to resemble peat in its highly acid qualities. Such land should be avoided, but when there is no choice, about 2 tons of cow manure should be placed in the pond and well mixed with the soil at the bottom of the pond to neutralise it. Such a pond should be filled and left for a month before fish are introduced. The acidity appears to be due to the organic acids in the dead mangrove wood and will always be a source of trouble and expense to counteract. This is a most important point and should not be overlooked when choosing a site.

The best ponds are those dug in sandy ground. Old sand pits are the most productive, yield the sweetest fish and require less preparation. At the commencement they will require cowdung at the rate of half a ton for a pond 10 feet x 50 feet x 3½ feet deep. The cowdung not only checks any slight acidity, but furnishes a manure for the algae so essential for aerating the water and a basis for the formation of silt for the silt feeding fish. Similarly, ponds dug in loamy ground are fairly suitable provided that the soil does not contain too much decaying wood. The only drawback in this case is that the fish are inclined to taste rather earthy. A ton of manure would be sufficient to start a pond of the above-mentioned dimensions.

Water Supply.

The water in the carp pond should not be changed or disturbed, and for this reason a stream of water through a pond is not only unnecessary, but a real drawback. The condition essential for the intensive stocking of a pond is that the natural cycle of plant—to animal—to plant through the agency of

A planked carp pond. Note that the planking is secured at every alternate stake by a cross piece nailed to a stake driven into the dry ground. This keeps the planking flat against the face of the inside.

A carp pond shewing the feeding enclosure, formed by three floating bamboo fastened together. It serves to localise the grass as it is thrown on the surface.

bacteria should be adjusted and maintained without disturbance. The waste of one fish will not only provide food directly or indirectly for another, but will assist in providing an abundant supply of oxygen dissolved in the water by maintaining a rich algal growth which performs this very necessary function. Within a short time, the relationships between the physical and chemical conditions of the water, the fish (and other animals) and plants become balanced. The waste of one variety of carp becomes food for another variety.

A carp pond free from mud will be tinted grass green and will be quite free from large-rooted water plants. This colour is almost entirely due to an alga (Microcystis sp.). Such a pond is certain to be well aerated and therefore healthy and productive. Very often, however, this green tint is masked in a pond dug in loamy soil, by the fish grubbing about and disturbing the mud; such a pond should not be condemned on this account.

The question of water supply is never particularly acute in Malaya because of the heavy rainfall, but it is an advantage to have a continuous non-acid supply of water available for "topping up" ponds to compensate for evaporation or leakage. Failing this, it is better to follow the system of the Chinese cultivators who rely on rain water which is probably the safest of all. They usually have a spare pond from which they draw water if necessary.

Temperature of Water.

It is probably due to the uniformity of temperature that such an excellent and steady balance of fish can be maintained in Malaya. The average annual temperature of the water in a pond at a depth of one foot is about 87°F. The extreme ranges may vary from 80° to 90°. On one or two occasions in 1930, when during a hot spell the day temperature of the water was as high as 94°F., no apparent adverse effect on the fish was noticed. The effect of a drop in temperature to 80°F., however, coincided with a phenomenally high mortality among the *Ctenopharyngodon idellus,* a subject which is discussed under the heading "Enemies and Ailments".

Effects of Acidity and Oxygen Content of Water.

A recent innovation in water investigation has been the introduction of various methods of ascertaining the acidity or alkalinity of natural waters by the determination of the hydrogen concentration usually signified by pH value. (Note: A low pH value indicates a high acidity). With older methods it was not possible to say whether a water was acid or alkaline, except when very definitely so, and there was nothing to indicate a very slight variation from the neutral point, and consequently the effect of these slight variations on the life of aquatic animals could not be estimated. With the recent introduction of more exact methods of determining these variations and experimental work on the reactions of aquatic animals to them, much has been learnt. In particular,

more exact information has been obtained on the reaction of fishes to the acidity or alkalinity of the water in which they live. As a rule even a slightly acid water is obnoxious to most fishes and may prove fatal to young carp. It is therefore a matter of considerable importance to know whether a water is satisfactory for their introduction. The Chinese fish culturist, in his great wisdom, has long known this by tasting the water.

Dissolved oxygen will vary in different ponds. As a rule the variation between one pond and another during the day is from 5 c.c. to 8 c.c. of oxygen per litre at the average temperature of 86°F. This variation is accounted for probably by the quantity of algae growing in the ponds which are more abundant in some than in others. On one occasion, when fish died in large numbers, the oxygen content in the pond was found to be as low as 2.5 c.c. per litre. All the common carp, Hypophthalmichthys, survived for three weeks and the mortality was entirely among the *Ctenopharyngodon idellus.* It might be argued that the low oxygen content of the water was the direct cause of death, but against this may be cited the case of another pond in which mortality was equally high, with an oxygen content of 7 c.c. per litre at 85°F.

The pH values in a cultivated pond may vary from 6.5 to 8. A newly excavated pond in mangrove will show a pH of 4.

During rainy weather the pH value of the water in a pond may drop from 7.5 to 6.5 if the rain quickly finds its way into the pond. This will be adjusted in the course of two days provided there is not more rain. Rain water seemed to be the cause of the death of many young carp in a newly constructed pond in which the pH value of the water was normally between pH 6.5 and pH 7, a drop to pH 5 caused by the rain water draining into the pond being more than the young fish could stand.

Carp Pond Foods.

Analyses made by Prof. J. Rosedale, Professor of Biochemistry at the Medical College, Singapore, and Mr. E. P. Jasinghe, of some of the foods of carp are appended below.

Chemical Analyses of Carp Pond Foods.

Samples obtained from Li Ji Siew's ponds in McPherson Road, Singapore.

	Water Percent.	Ash Percent.	Nitrogen Percent.	Fibre Percent.	Ether Extract Percent.
1. Duckweed	93.456	1.592	.3908	.731	—
2. Microcystis	93.364	1.024	.525	.229	.265
3. Bottom Scrapping of pond	72.07	23.16	.0074	—	.118
4. Bean Meal	13.62	4.01	6.998	4.151	7.559
5. Flour	14.85	.46	2.400	—	.644

Fattening Pond.

Returning now to the batch of 600—700 grown fish, which it is assumed have been put into a good pond, steps must be taken to provide the necessary food. For *Ctenopharyngodon idellus*—the grass eater—a simple enclosure of three bamboo poles secured at right angles is made. These are floated on the surface of the water and when the free ends of the two parallel sides are pushed into the bank a rectangular area is bounded on three sides by the flaoting poles and on the other by the bank. If a corner of a pond is used, only two floating poles are necessary. Grass is scattered on the surface within this area and is thus prevented from blowing about.

The fish soon become accustomed to the feeding places. Prof. Y. T. Chu of St. John's University, Shanghai, states that *Ctenopharyngodon idellus* first cuts the grass sideways with the lateral dentations of the comb-shaped teeth against the dorsal plate. The "White Fish" and the "Big Head", *H. molitrix* and *H. nobilis* must content themselves with the excreted faeces of the grass eating fish and in fact this is their main food. The faeces of this fish are cylindrical and float on the surface of the pond in curved lengths varying from 1 to 4 inches. They are firm and composed entirely on half digested grass and will remain on the surface of the water for a long time before disintegrating.

The grass fish will require daily not less than a quarter of their own weight in grass and it is advisable to have the supply at hand. When the fish have grown to marketable size, the provision of grass is no light matter, since for a hundred fish this will necessitate securing about one cwt. of grass each day.

In swampy grass land, a comparatively small area will be sufficient as the cut grass regenerates quickly and is soon ready for cutting again.

The fish will eat the fleshy stems of banana plants and maize leaves, but these do not grow either quickly enough or in sufficient quantities to be used as a general food. Steps should therefore be taken to lay out sufficient ground for grass production. Experiments in this direction are not completed and it cannot be stated exactly what grass growing area will be required, but promising results have been obtained by planting Guinea grass, a quick-growing good fodder grass, close to an experimental pond with a view to ascertaining the value of this grass as a food.

It is a common assertion that one of the articles of diet supplied to carp is human excreta. There is no evidence to confirm this, but the fact that the Chinese builds his small wooden bath house over the pond is probably responsible for the statement. It should be remembered also that the Chinese consider that human excreta is too valuable to use in this way owing to its use for vegetable culture. Sometimes in the absence of any other manure, Chinese will use a small amount of liquid night soil in a deep pond, when necessary, but the dilution is instantaneous and so great that it could not possibly be used as food by the fish. It is put in as a fertiliser, not only to stimulate the growth of algae and to improve the oxygenation of the water, but to enrich the silt in

the normal way of manuring. The Chinese also state that it will raise the temperature of a pond. The actual amount which might be used in a pond 100 feet x 50 feet x 3½ feet would never exceed sixteen gallons per annum, and would be introduced in small quantities at a time. Even if it were all put in at once, the dilution would approximate to 1 in 10,000. Occasionally, the bath house may be used as a latrine and the faeces are sometimes eaten by the cat fish (Clarias), a fish which generally manages to find its way into the ponds, but which is of no value.

The Chinese say that human excreta is only used in deep ponds between 5 feet and 7 feet deep, shallow ponds needing only cow manure. There is definite evidence that human excreta can be dispensed with and the pond in Alkaff Gardens, Singapore, is an example where big carp up to 30 lbs. in weight thrive without it. A pig pen may drain into a fish pond, but again the dilution of the excreta is so great that it does no harm, neither does it become offensive.

Stocking and Estimate of Yield.

With careful attention, losses of fish should not exceed 30 per cent. Such losses generally occur during the early stages of development and the greatest danger is overcrowding. Not only is this likely to cause death among the fish but it retards their growth. Steps should be taken when the fish are ten inches long to reduce the number. There is some difference of opinion as to how many fish should be allotted to a unit area but a safe figure is to allow a fish, when 3 or 4 pounds in weight, 50 square feet of surface area in a depth of water 3½ feet to 4 feet. Thus, a pond 100 feet x 50 feet x 3½/4 feet deep should rear 100 fish to a marketable size of approximately 4 lbs. in weight within one year. This figure excludes the Common Carp and the other Cyprinid which will probably only attain weights of 1½ lbs. and ½ lb. respectively in this period. The varieties of fish must be assorted in proportions mentioned previously and precisely the same method of feeding continued as before thinning out.

Enemies and Ailments.

There is always a danger from water snakes and sometimes otters and only the keenest vigilance can deal with these. Snakes are extremely difficult to keep out as they seem to gain access to the pond when they are small, and are very skilful in concealing themselves. For this reason wire netting is often a waste of money. They can hide in the mud and need only occasionally come to the surface for air, for this purpose putting out very quietly just the tip of the nose. A snake, 3 feet long, will swallow a fish ¾ lb. in weight and it is only when they have taken a fish and come to the surface that they are detected.

Although, as stated previously, acidity of the water will soon prove fatal to fish, excessive alkalinity is not without its bad effects. This latter condition

may occur as a result of overcrowding or overmanuring of the ponds. When the ammonia value become high, say 0.0005 per cent. it has been noticed that the fish may become badly affected with Lernean Copepod parasites, which the Chinese will remove one by one, at the same time, removing the fish to a less crowded pond. Similarly the two Hypophthalmichthys are liable, under such conditions, to become affected on the body with red sores not unlike Furunculosis in salmon. The Chinese are well aware of the contagiousness of this complaint and take prompt steps to net all the fish and to transfer those affected to an isolation pond.

A drop in temperature occasions great anxiety since little can be done to counteract it. During the unusually cold and wet weather in November, 1930 following a period of comparative drought and hot weather, the mortality among the stocks of *Ctenopharyngodon idellus*—the grass fish—was remarkable. Although deaths are expected at this time, no such mortality had been known previously in Singapore and it has indeed been ascribed to the work of some devil.

All kinds of ponds were affected, but it was only *Ctenopharyngodon* which suffered. Estimations of oxygen and pH value were carried out in various affected ponds, at the same time, and although they varied, they were in no way abnormal. The food was unchanged; and the fish were receiving precisely the same treatment they had always received.

The factor common to all was the low temperature and it is suggested that this particular fish caught cold.

The fish first went off their feed and the next symptom was the horizontal attitude they assumed when swimming with the dorsal lobe of the tail out of the water. They were continually gasping for air and ultimately turned on their backs and died. The apparent illness lasts for about two days and it seems as if once stricken there is no recovery. The gills were pale and the gill filaments along the edges of the gills seemed to have decomposed. Internally, all the organs appeared to be normal except that the gall bladder was distended with gall of a normal colour and the kidney appeared to be inflamed and very soft. There was a watery blood discharge and the anus had a red inflamed appearance. The intestines were all empty, but the dead fish outwardly looked bright and no internal parasites could be found. The conclusion that these fish had caught cold is suggested by the fact that they always seek their food on the surface of the water, and it is thought that during the heavy downpours of cold rain they came in contact with an upper layer of chilly water which may have caused some affection of the gills or a derangement of their secretory and excretory organs.

It is well known that fish are sensitive to sudden changes of temperature and this is amplified by the fact that the greatest care must be taken when transferring them from one water to another.

Predatory fish such as 'aruan' (Ophiocephalus), 'keli' (Clarias), 'betok' (Anabas) are only dangerous among the small fish and must be cleared from

a pond before small carp are put in. All these predatory fish will, sooner or later, find their way into a pond, but provided that the carp are over six inches in length, there is not much danger unless an exceptionally large 'aruan' (Ophiocephalus) enters the pond. Clearing a pond may prove not only expensive, but often of great inconvenience where the only water supply is rain. The Chinese have a very effective and cheap method of poisoning the fish without draining off the pond. They brew an extract from pressed waste tea stalks which are imported into Singapore in the form of hard cakes resembling cattle cake. The cake is known in Chinese as Teh Chee Ko. The amount required depends on the size of the pond to be treated but taking the unit 100' feet x 50 feet x 3½ feet (deep) 200 lbs. is sufficient to produce a strong tea extract. Within 24 hours all the fish within the pond are killed. The pond should now be left for fourteen days by which time it will have resumed its former condition and will be fit for use again. The tea waste is extremely cheap usually being sold for about 1½ cents per pound.

Fish Ponds and Malaria.

The question of mosquito control in fish ponds in relation to malaria is an important problem and much research is needed before any definite conclusions can be advanced. The Chief Health Officer, Federated Malay States, reports that the following anopheline mosquitoes breed in fish ponds in the Kinta and Kuala Lumpur Districts:—*A. barbirostris, A. hyrcanus, A. leucosphyrus, A. rossi, A. sinensis.* This list omits the common malaria carriers *A. maculatus, A. ludlowi* and *A. umbrosus.* He further states that among the first mentioned group several are potential carriers of malaria and one at least has been found to be infected under natural conditions and it has been conclusively show that mosquitoes will deposit their eggs in any kind of water if they are deprived of their favourite habitat. This is a fair statement of the situation. The experience gained in Singapore is that the carp ponds, if under full cultivation, will not produce mosquitoes, but directly the pond goes out of cultivation mosquitoes appear.

When a pond goes out of cultivation, it assumes a more pleasant appearance than when it contains fish. The water soon becomes clear and acid and rooted pond-weeds appear. Previously it would be green or muddy, without rooted pond weed and distinctly alkaline--probably due to the organic 'pollution". Under these conditions it appears that mosquitoes may not lay their eggs, or that eggs will not develop in a polluted water, and this point should be clearly established during the investigation. The prior importance of health, particularly in relation to malaria, cannot be overlooked. On the other, the local production of a most important source of food of high value must be conserved.

There should be no objection to the industry being carried out in rural areas and it might be an excellent plan to cultivate mining holes which are at present producing mosquitoes and which cannot be drained. The Chief Health Officer, Federated Malay States, is of the opinion that carp farming cannot be carried on in Sanitary Board areas, or within a radius of half a mile of

METHOD OF NETTING CARP.

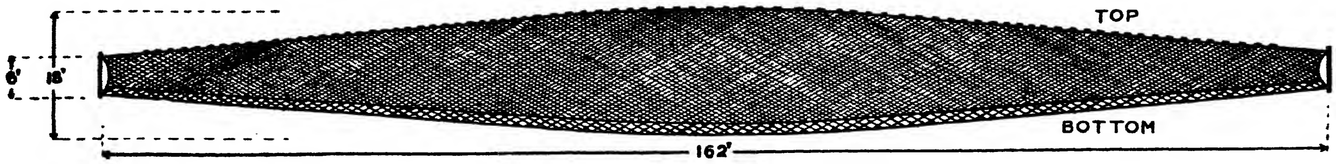

Fig I

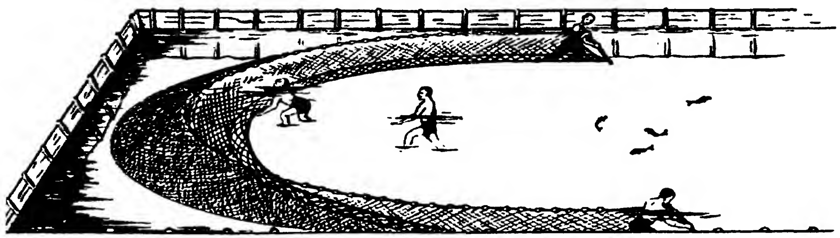

Fig II

FIG. I.
Fish net. The corks at top are made of "pulai" and the net is of one inch mesh. Attached to bottom of net is a strip of coarse 2 inch mesh net bounded by a heavy foot rope. This foot rope saves the finer mesh above.

FIG. II.
Hauling the net. The men in the centre not only drive the fish into the net, but free the foot rope from obstructions and take care that it keeps on the bottom.

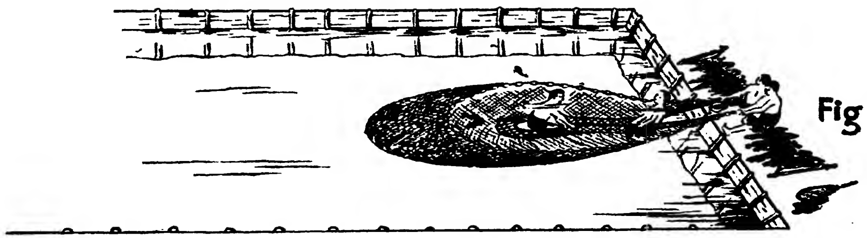

Fig III

FIG. III.
Hauling the catch. The men in the pond hold the foot rope together to prevent the escape of fish where the net lifts when leaving the bottom.

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such areas without danger to the inhabitants. This is quite reasonable until more is learnt about mosquitoes. There is always a danger of a careless cultivator allowing puddles to form near his ponds, and often a small pit is dug to receive fish for a temporary period.

In the interests of the industry, it is probably necessary to make regulations to ensure that the fish pond is being cultivated in a proper manner.

Costs.

It should be borne in mind that carp rearing in Malaya is carried on almost exclusively by Chinese small holders and costs in terms of money may be misleading. The main expenses in connection with this industry are direct labour charges, apart from the cost of the fish for stocking, planking to maintain the sides of the pond and a trifling amount for peanut cake.

If it is necessary to engage labour to dig a pond, 100 feet x 50 feet x 4 feet deep, this would cost to day $250, plus say $100 for planking, making a total of $350. Such a pond would produce 300 kati (i.e. 400 lbs.) of fish per annum which would realise $75 (£8-15-0) at 25 cents per kati. This is a conservative estimate of cost of production and sale. Therefore, only those with sufficient capital can afford to wait for as long as 4 or 5 years before they recover their capital.

The Chinese immigrant as a rule has no capital. He therefore digs his pond in his spare time when not planting vegetables. Often neighbours will combine in making a pond and form a partnership, taking no payment for their labour, but sharing in any profits.

The Malayan Carp Ponds.

A conservative estimate based on figures supplied from the various States in Malaya shows that there are at least 200 acres of fish ponds in cultivation. It is noted that the present tendency is for the number of fish ponds to increase. Basing figures on the estimate of 400 lbs. of fish per 5,000 square feet of water at 25 cents per kati i.e. 7 pence per lb. approximately 300 tons of fish are produced annually, valued at approximately £20,000 sterling.

The industry is primarily suited to small holders. The farther they are away from the crowded areas the less likely they are to antagonise Anti-Malaria Boards.

Malays object to the fish mainly on aesthetic grounds and often because of the proximity of the pig pens to the ponds. They cultivate the Common Carp since this fish will grow in almost any pond. If Malays can be shown that neither human nor pig excreta are necessary for carp rearing it is believed that they could be induced to try the other kinds in addition.

Much valuable assistance in this work has been given from time to time by Prof. J. Rosedale of the Medical College, Dr. K. B. Williamson who is now engaged in anti-mosquito work in the Cameron Highlands, and Mr. E. J. H. Corner of the Botanic Gardens, to whom the author tenders his grateful acknowledgements.

OIL PALM FACTORY AT SERDANG.

BY

B. Bunting,
Agriculturist,

AND

C. D. V. Georgi,
Acting Agricultural Chemist.

Introductory.

In view of the importance of the oil palm as a plantation crop in Malaya considerable attention has been devoted by the Department of Agriculture to its cultivation at the Experimental Plantation, Serdang.

The area at present planted at the Experimental Plantation with this crop amounts to approximately 175 acres, while further extensions are contemplated.

An essential part of every oil palm estate is the factory for the preparation for export of the two products, palm oil and palm kernels. With such a comparatively large area under experimental cultivation sufficient fruit is available to warrant the installation of a large scale plant to study the various methods of treatment of the fruit under estate conditions. The factory recently established at Serdang serves the double purpose therefore of utilising the fruit harvested from the different experimental plots and of allowing various investigations to be carried out on the methods of manufacture.

Description of Plant.

The plant in the factory has been selected with a view to comparing the two systems at present in use for the extraction of palm oil, namely, the centrifugal system and the press system. Both a centrifugal extractor and a press have therefore been installed, necessary arrangements being made for either machine to be used with the remainder of the plant which is common to both systems.

The following is a detailed description of the plant at present installed :—

(1) Two mild steel sterilisers, each having a capacity of 5 cwts. of cleaned fruit.

(2) One mild steel elevator.

(3) One "Weston" type centrifugal extractor complete with digester, capacity 5 cwts. of fruit per charge.

(4) One hydraulic press, complete with stirring-kettle, capacity approximately 10 cwts. per hour.

(5) One hydraulic pump for press.

(6) One spiral screw conveyor for discharge of refuse from centrifuge or press.

(7) Three mild steel washing tanks, each with a capacity of approximately 250 gallons.
(8) One mild steel sludge tank having a capacity of approximately 120 gallons.
(9) One combined storage and washing tank for final purification of oil.
(10) One De Laval centrifugal separator, size No. 300, having a purifying capacity of 110 gallons of oil per hour.

The centrifugal extraction plant, comprising elevator, digester, centrifugal extractor and conveyor, was supplied by Messrs. Manlove, Alliott & Co. Ltd.. Nottingham, and the press installation, comprising stirring-kettle, hydraulic press and pump, by Messrs. Gebr. Stork & Co., Amsterdam.

The necessary power plant consists of one Ransome's No. 16 loco-multitubular boiler and one No. 12 compound girder-frame steam engine. The boiler, which works at a pressure of 160 lbs. per square inch, is fitted with an extra large firebox to burn the waste fibre and shell from the factory. Both the boiler and engine were supplied by Messrs. Ransomes, Sims and Jefferies, Ipswich.

Methods of Working.

The following is a brief description of the present method of treatment of fruit in the factory:—

Collection of Fruit.—The fruit bunches after harvesting are taken to collecting sheds where they remain for 5 or 6 days to facilitate separation of fruit. Immediately after separation the cleaned fruit is transported to the factory for treatment the same day.

Steriliser.—On arrival at the factory the fruit is weighed and placed in the sterilisers in which it is treated with live steam for a period of one hour. The sterilised fruit is then transferred by means of an elevator to a hopper placed above the digester for subsequent treatment in either the centrifugal extractor or the press.

Centrifugal Extraction.—The fruit from the hopper is fed into a closed digester, fitted with revolving arms, in which it is treated for 25 minutes. The digester is steam-jacketed, while steam is also admitted to the body of the digester. A steam pressure of 45 lbs. per square inch is maintained in the jacket, but approximately only 5 lbs. per square inch is required inside, this amount being sufficient to assist in softening the walls of the oil cells and facilitating disintegration of the fruit. The time required to transfer a charge from the steriliser to the digester is approximately 5 minutes.

The mashed fruit is transferred by gravity to the centrifugal extractor in which it is treated for a period of 15 minutes. The normal speed of the extractor is 900 revolutions per minute and it is essential that this speed be maintained during the whole period of extraction. The centrifuge is fitted with a bottom discharge, which permits of easy removal of the pericarp residue and nuts to the spiral conveyor situated below.

It takes approximately 5 minutes to transfer the mashed fruit from the digester to the centrifugal extractor, a similar period being required to discharge the refuse into the conveyor. The centrifugal extractor is 42 inches in diameter and 20 inches deep and has a working capacity of approximately 5 cwts. per charge. Allowing for 10 charges per working day of 8 hours the capacity of this plant is therefore approximately 2½ tons of cleaned fruit per day.

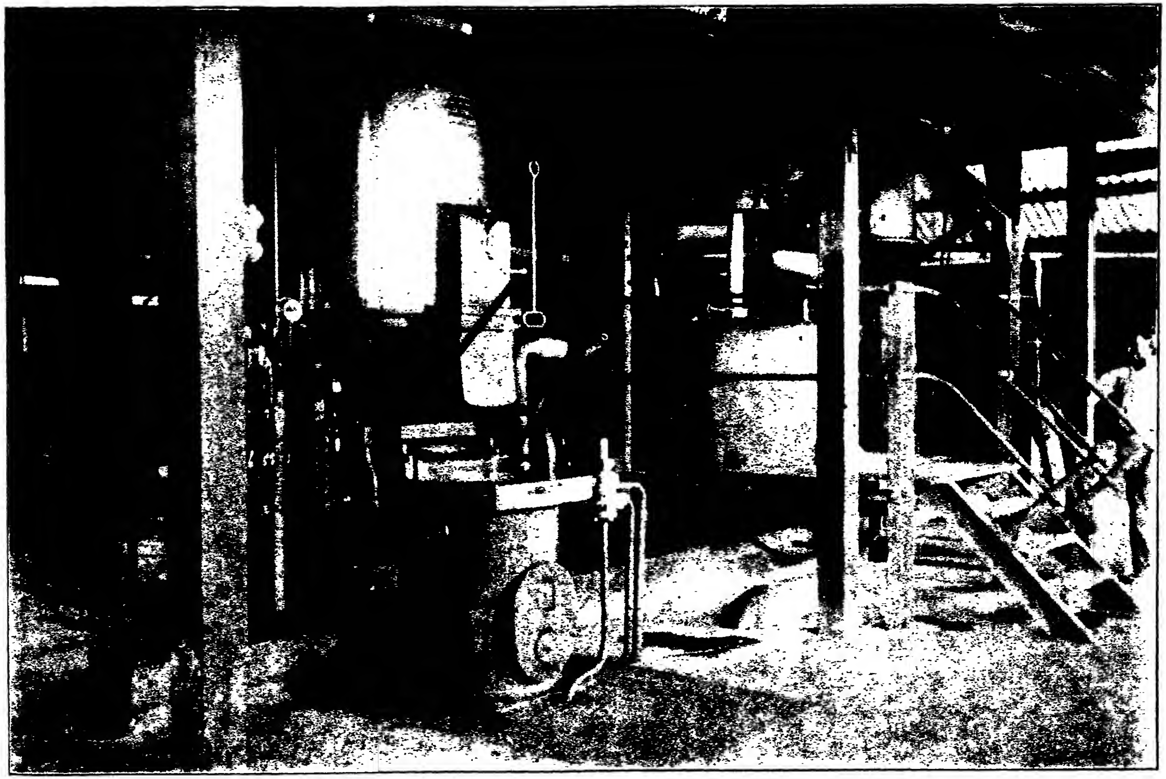
Hydraulic Pressing.—In the case of the press the sterilised fruit is conveyed into an open stirring-kettle provided with steam-jacket which may be submitted to a working pressure of 45 lbs. per square inch. The kettle has a capacity of 250 kilogrammes (approximately 550 lbs.) of fruit. The digestion of the fruit is effected by means of steel stirring arms fixed to a vertical shaft revolving at about 30 revolutions per minute. The fruit is digested for a period of 20 minutes, after which pressing is commenced. The press, which is of a closed cage type of special design and is also steam-jacketed, is situated below the stirring-kettle, charging being effected by means of a hand-operated shutter fixed at the base of the kettle. The amount of mashed fruit removed from the kettle when filling the press is replaced by an equivalent amount of sterilised fruit so that the level of mash in the digester remains constant. The mashed fruit is packed in layers of about 4 to 5 inches deep, each layer being separated by a steel plate, the function of which is to distribute the pressure evenly during the operation of pressing and to facilitate the discharge of the press cake. The capacity of the press is 60 kilogrammes (approximately 132 lbs.).

The press is operated by means of a hydraulic pump of special design. This pump contains three plungers working at varying pressures as follows:—

(a) low pressure,	75 kilogrammes per square centimetre.
(b) medium pressure,	175 kilogrammes per square centimetre.
(c) high pressure,	350 kilogrammes per square centimetre.

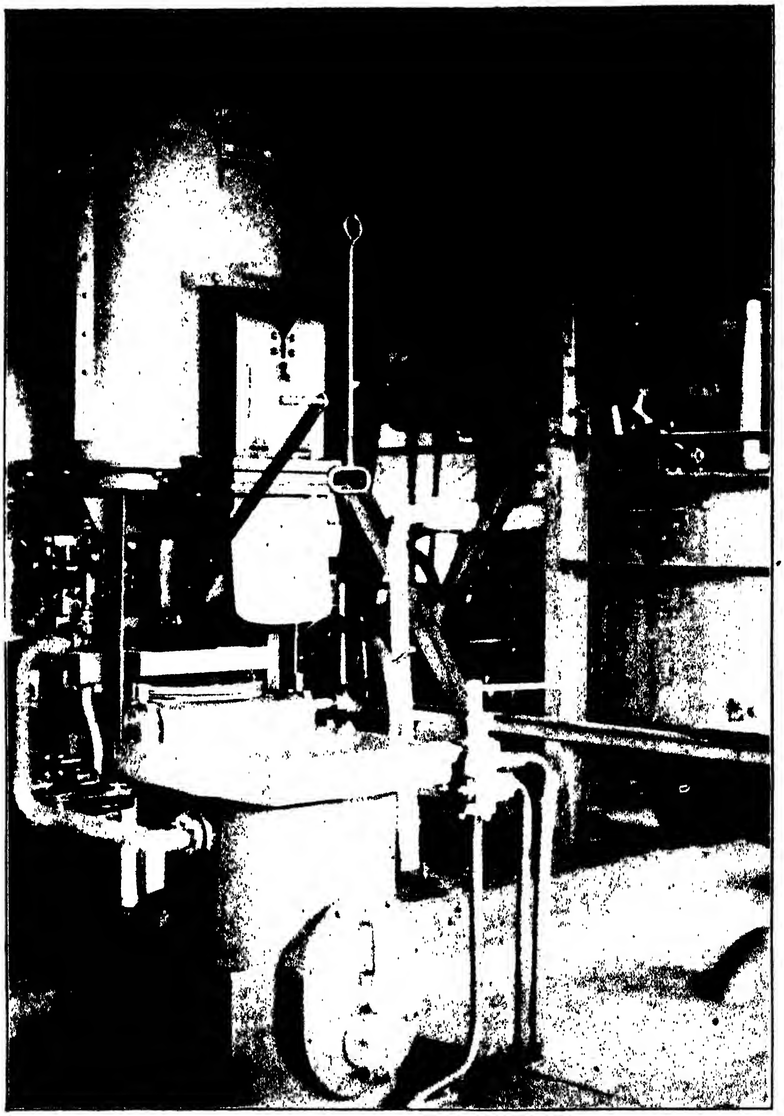
When working the pump the change from one pressure to another is effected automatically as the pressure exceeds the maximum limit. In the case of the high pressure the pump is capable of developing a pressure of 450 kilogrammes per square centimetre, but a working pressure of only 350 kilogrammes per square centimetre is maintained. The liquid used in the pump may be either lubricating oil or an emulsion of oil and water to which a small amount of good quality neutral soap is added.

The press is capable of rapid working, but this depends entirely on the skill of the operator. Allowing one minute for filling, four minutes for pressing and one minute for discharging, 10 charges, equivalent to approximately 12 cwts. of fruit, can be operated per hour. It is stated, however, that a skilled operator is capable of maintaining a regular output of 12 to 14 charges per hour. Such a rate must of necessity reduce the period of actual pressing and unless the residue is being subjected to further treatment for



Oil Palm Factory at Serdang.

General View showing both Press and Centrifugal Extractors.



OIL PALM FACTORY AT SERDANG.

STORK HYDRAULIC PRESS SHOWING STIRRING-KETTLE ABOVE.

oil recovery it would appear advisable in the case of single treatment of fruit to work the press at a slower rate in order to obtain an increased recovery of oil.

Oil Receiving Tank.—The crude oil and water discharged from either the centrifuge or the press passes into a cylindrical tank having a capactiy of 75 gallons. The tank can be closed and steam admitted by means of a valve; this has the effect of forcing the oil from the tank along the pipe leading to the washing tanks.

Washing of Oil.—The washing tank having been filled to the necessary height the mixture of crude oil and water is boiled with live steam for two hours. The contents of the tank are then allowed to settle for about 18 hours, after which the water is run off from the bottom of the tank until oil appears at the test cock, situated a few inches above the base of the tank. The washed oil is run off through the main cock fixed in the side of the tank into another cylindrical tank situated just below ground level. The latter is similar in construction to the oil receiving tank described above, the washed oil being forced by steam to a storage tank situated above the De Laval centrifugal separator.

In the case of crude oil from the press it has been found necessary to add approximately half its volume of water in order to ensure a satisfactory separation of the oil, sludge and water after boiling.

Sludge Treatment.—The residue from the washing tank is transferred to a smaller tank of similar design in which the mixture of oil, sludge and water is treated with live steam for a period of two hours and then allowed to settle for approximately 18 hours. The separation of the water and oil is effected in a similar manner to that employed in the washing tank, the oil being transferred to the storage tank for treatment in the De Laval purifier. The residue in the tank is afterwards thrown away, since experience has shown the further recovery of oil to be impracticable.

De Laval Separator.—The washed oil from the storage tank fitted above the centrifugal separator is first heated to a temperature of approximately 75°C. and allowed to flow by gravity into the base of a further washing tank, which is also filled with hot water of the same temperature. The oil, being lighter than water, rises to the surface and is washed in transit. When the oil layer is of sufficient depth the oil overflows through a pipe leading to the De Laval separator in which the oil and water are separated, the two liquids being discharged through different outlets. The small quantity of matter in suspension in the oil is retained in the bowl of the separator. The purified oil is then passed over a zinc tray in order to reduce the temperature before being delivered into barrels through an automatic filler.

Shipment of Oil.—The oil is at present packed in barrels made of Californian fir, the barrels being assembled on the Plantation. A finished barrel weighs about 60 lbs. and has a capacity of approximately 40 gallons,

which is equivalent to approximately 375 lbs. of palm oil per barrel. Six barrels are therefore required for each ton of oil.

Extension of Plant.

As is well known, the latest factory practice on estates is to sterilise the fruit bunches under pressure, the fruit being separated subsequently by means of mechanical strippers. No provision has yet been made for the installation of such a plant in view of the fact that the results of many of the field experiments at present being carried out are based on records of the amount of cleaned fruit on account of the large variation found in the composition of bunches from young palms. The installation of a bunch steriliser will be considered, however, at a later date when with more mature palms there will be less variation in the composition of the bunches and it will be possible to rely upon weights of bunches for purposes of record.

Further, no arrangements have yet been made for the treatment of the residue of pericarp and nuts from the centrifuge or press. This matter is, however, receiving consideration and a screen for separating the nuts from the fibrous residue, a nut-cracker and a dry separator for dealing with the cracked nuts will be installed later to complete the plant.

In view of the present unsatisfactory prices prevailing for palm oil it is not proposed to consider the installation of either a heavier type press or a solvent extraction plant for the further treatment of the fibrous residue.

Proposed Experimental Work.

The following is a summary of the proposed experiments which it is intended to carry out in connection with the treatment of the fruit in the factory :—

(1) Sterilisation of fruit for varying periods having regard to the acidity of the resultant oil.

(2) Centrifuging of fruit under varying conditions with the object of determining those required for the maximum recovery of oil.

(3) Pressing of fruit for varying intervals with a view to ascertaining the optimum period for obtaining the maximum recovery of oil.

(4) To determine the extent to which the recovery of oil is possible by further treatment of centrifuged pericarp residue in the press.

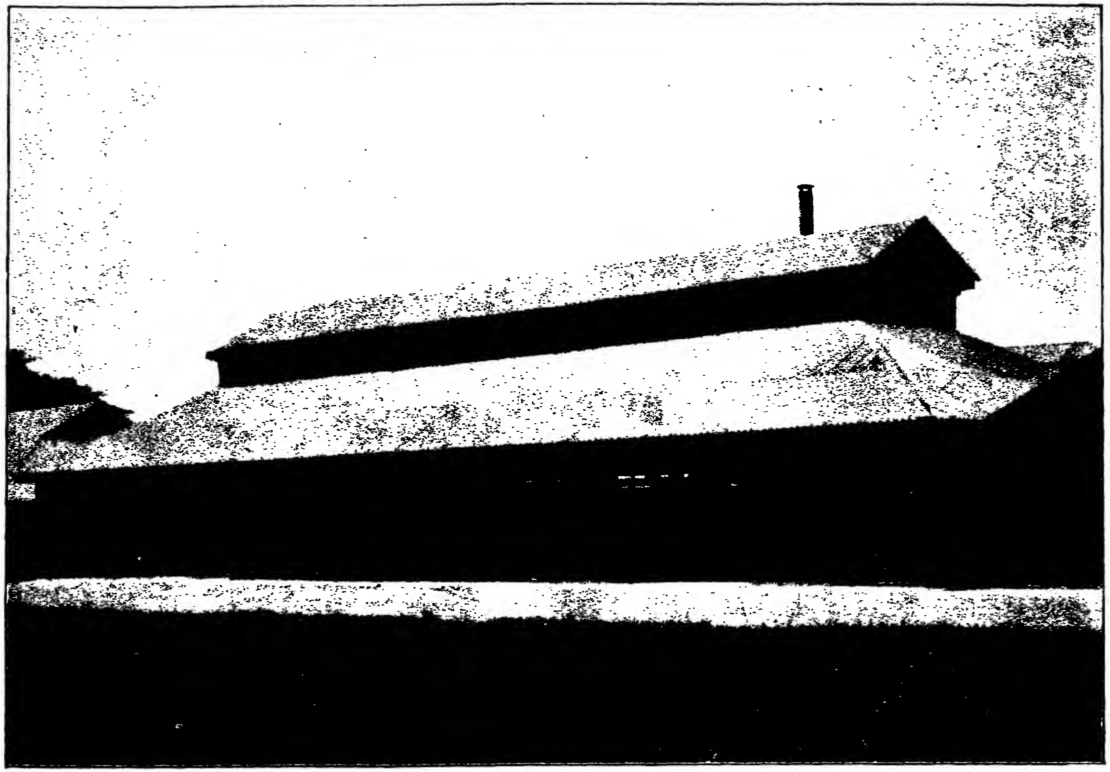
(5) Losses of oil in purification of crude oil from both centrifuge and press under varying conditions of treatment during the washing process.

(6) Comparison of the relative efficiencies of the centrifuge and press.

(7) Institution of methods of factory control for the most economical treatment of fruit in the factory.

General View of Palm Oil Purification Plant

at the Serdang Experimental Factory.



View of Serdang Experimental Oil Palm Factory.

General.

At present the yield of fruit from the area under cultivation is only sufficient to warrant the factory working two days per week, but with the greater productivity of the palms on account of increasing age and the extension of the area the factory will gradually have to be run more frequently to deal with an increased output.

In this connection it may be interest to note that the weights of fruit treated and the amounts of oil recovered during the last four months have been as follows:—

Month	Weight of Fruit lbs.	Weight of Oil lbs.	Percentage Recovery.
April	40,984	11,123	27.1
May	38,859	10,465	26.9
June	31,417	8,897	28.3
July	36,928	10,297	27.9

The comparatively high figures obtained for percentage recovery are due partly to the absence of trash and undeveloped fruits and partly to the loss of moisture during storage in the collecting sheds.

With regard to the quality of oil the average acidity, calculated as palmitic acid, during the above period was approximately 4.5 per cent. The average moisture content was 0.31 per cent. while the matter in suspension has always been less than 0.01 per cent.

The slight increase in the figure for the acidity of the oil, compared with that for normal estate practice, can be attributed to the bruised condition of that proportion of the fruit which before treatment in the factory is required for compiling records of yields in connection with various experiments.

GAMBIER AS A CATCH-CROP WITH OIL PALM.

BY

C. D. V. GEORGI,

Acting Agricultural Chemist,

AND

E. A. CURTLER,

Assistant Agriculturist.

Introductory.

The present paper summarises the results of an investigation carried out at the Experimental Plantation, Serdang regarding the cultivation of gambier as a catch-crop with oil palm, a preliminary account of which was published in this Journal for November, 1929.

Although it is not proposed to describe again the lay-out of the plot, the methods both of harvesting the fresh shoots and of the extraction of the gambier a brief account of the whole experiment will be given since the work has now been completed.

Summary of Experimental Work.

The area of the plot comprised one acre, the oil palms being planted 28 feet x 28 feet triangular.

The gambier seedlings were planted in November, 1925, some six months after the oil palms had been established.

Three rows of gambier were planted in the avenues between the palms, the approximate width of an avenue being 24 feet. The rows of gambier were spaced 6 feet apart with the same distance between the rows.

Harvesting commenced towards the end of October 1926, that is approximately one year after planting in the field.

In February, 1927 it was decided to utilise the plot for the additional purpose of ascertaining the variations in yield between harvesting after different periods, those chosen being 3 months, 4 months and 6 months respectively.

In February, 1928 the two outer rows of gambier plants from each group in the plot were removed owing to the development of the oil palms being obstructed, while in February, 1930 it was decided for the same reason to cut out the remaining row, the experiment terminating after a period of nearly four and a half years.

Periodic Harvesting of Gambier.

The following table, Table I, gives the details of the annual yields of the fresh prunings, having regard also to the periodic harvesting of the plants,

TABLE I.

Annual Yields of Fresh Gambier Prunings.

Period between harvesting. months.	Annual yields from groups of plants. No. of plants.	Weight of fresh prunings. lbs.	Average yield of fresh prunings per plant. lbs.	
A. First year, Feb. 1927 --Feb. 1928.				
3 months	271	4538	16.7	15.9
4 months	260	4271	16.4	
6 months	259	3800	14.7	
B. Second year, Feb. 1928 —Feb. 1929.				
3 months	90	1425	15.8	17.4
4 months	87	1561	17.9	
6 months	84	1563	18.6	
C. Third year, Feb. 1929 —Feb. 1930.				
3 months	90	895	9.9	11.5
4 months	86	1065	12.4	
6 months	84	1037	12.3	

The slight increase in the average yield per plant during the second year may be due to the increased vigour of the remaining row of plants as a result of the removal of the two outer rows. There is, however, a marked decrease in this figure during the third year of the experiment.

Yield of Gambier.

In connection with the periodic harvesting of the crop the following table, Table II, shows the figures for the moisture-free gambier content of the fresh cuttings. In order to make the table as concise as possible only the averages for the different years are given.

TABLE II.

Average Moisture-free Gambier Content of Fresh Prunings with Varying Periods of Harvesting.

Period of Experiment.	3 months	4 months	6 months
	per cent.	per cent.	per cent.
A. First year, Feb. 1927—Feb. 1928.	6.7	7.0	6.7
B. Second year, Feb. 1928—Feb. 1929.	6.4	7.3	6.3
C. Third year, Feb. 1929—Feb. 1930.	6.7	7.9	6.0

The results indicate an optimum period of cutting at intervals of 4 months, thereby confirming the figures published previously.

A further table, Table III, shows the figures for the calculated yields of moisture-free gambier for the three years of the experiment during which periodic harvesting was carried out.

TABLE III.

Calculated Annual Yields of Moisture-free Gambier.

Period of harvesting months.	Feb. 1927 to Feb. 1928. lbs.	Feb. 1928. to Feb. 1929 lbs.	Feb. 1929 to Feb. 1930 lbs.	Total lbs.
3	308.2	90.9	60.0	459.1
4	299.1	114.8	84.1	498.0
6	255.1	97.1	62.2	414.4

In view of the fact that such a large proportion of the gambier plants was removed at the end of the first year, compare Table I, the results, except in the case of the second and third years, are not comparable. The diminution in the yield of gambier during the third year compared with that for the second year is however marked.

In this connection also it may be interesting to record that the total calculated yields of moisture-free gambier from the various series of groups during the whole experiment would be as follows:—

Period of harvesting. months.	Calculated yield of moisture-free gambier. lbs.
3	557.4
4	594.4
6	509.4
Total	1661.2 lbs.

Remarks and Conclusions.

Although the figures for the weights of the fresh prunings during the separate years of the periodic harvesting experiment show little significant difference, those for the analysis of the extracts clearly indicate an optimum period of cutting at intervals of about 4 months.

With regard to the method of extraction it is recognised that the period of treatment would be insufficient to permit of complete extraction of all soluble matter. As pointed out previously, however, such a method was adopted since it was desired to follow as far as possible the practice that would in all probability be adopted on an oil palm estate merely growing the gambier as a catch- crop.

The calculated total yield of moisture-free gambier from the plot during the whole experiment amounted to 1661 lbs. (approximately 12.5 piculs). Assuming that all the gambier had been harvested at the optimum period it can be calculated that the yield of moisture-free gambier over a period of three and a half years would be approximately 13.5 piculs per acre, of which approximately 66 per cent. would be recovered during the first 18 months of harvesting, the amounts for the remaining two years being 19 per cent. and 15 per cent. respectively.

The average moisture content of commercial bale gambier is approximately 50 per cent., so that for the purposes of calculating the yield of the commercial product the above figures should be doubled. This would increase the total yield for the whole period to 27 piculs per acre, of which approximately 18 piculs would be recovered during the first 18 months of harvesting, but only 5 piculs and 4 piculs respectively during the remaining two years.

The comparatively low yields of gambier obtained during the last two years of the experiment are due to the removal of such a large proportion of the original plants and it is extremely doubtful whether gambier planted under such conditions would prove remunerative.

The results show that if the maximum return is to be expected from the gambier it should be planted a year ahead of the oil palm. In such a case the possibility of soil erosion would have to be considered and the establishing of this catch-crop at such an early stage of development of the oil palm estate would have to be restricted to flat areas. Experience has also shown it to be necessary to keep the gambier plants clear of the palms at all stages in view of their tendency to smother the palms and obstruct their development.

Reviews.

Report of the Committee on Soil Erosion.

Ceylon Sessional Paper III—1931, 54 pp. 18 figs. and index. Government Record Office, Colombo. Price Rs. 1.10.

When tropical agriculture was conducted on a comparatively small scale, the question of damage by soil erosion was of only local importance. Particular small areas might be damaged in this way, but land was relatively cheap and the financial returns on a sufficiently generous scale, so that little attention was directed to the loss of capital incurred by reason of soil erosion.

The subject gained a new significance during the era when large areas of land were developed for such crops as rubber, tea and coconuts. The damage then became not merely confined to the particular estate, but was so general and of such a magnitude that the course and navigability of rivers was affected and widespread damage by flood was consequent on the silting up of rivers.

This is the experience not only of Ceylon, but of all tropical countries with a heavy rainfall.

Unfortunately, it was not until the damage caused by this denudation had continued for some years that the gravity of the situation was fully appreciated and somewhat belated steps were taken to minimise future losses by this cause and consideration was given to the problem of reconditioning land which had suffered in this respect.

The report before us is divided into five chapters and contains four appendices. It states the nature and extent of the damage by soil erosion particularly as it affects Ceylon. The problem in Ceylon is closely examined, the damage occasioned by this cause carefully set out and some account given of the steps taken in that Colony to preserve the soil from future damage.

The attitude of the agriculturists towards soil erosion, the views of the Committee and its recommendations are the subjects of sections and are dealt with in some detail.

Emphasis is laid on the fact that soil erosion is caused primarily by the free movement of water on the surface of the ground. In view of the fact that "doubling the velocity of water increases its transporting power sixty-four times", the key to the problem of soil erosion is the prevention of this movement of surface water. Consequently, the old idea that drains should be designed to take water off the land as quickly as possible is obsolete.

The Committee strongly condemns the practice of clean clearing and gives particular attention to cover crops and their effects. It would appear that there is a distinct prejudice against a cover crop with tea, a crop which would especially require some such protection, as it is frequently planted on steep slopes. The attitude of the agriculturist in Ceylon is stated to be "moderate rather than advanced, and it may be repeated that the impression was gained again and again that many planters were prepared to modify their views and

take further action if they were persuaded that modification and action were desirable". But the Report states elsewhere that the Committee were appalled by the actual denudation which is going on apparently unchecked and they could but draw the conclusion that many did not realise the gravity of the situation. They further found that in general the treatment of new clearings left much to be desired, the steps taken to prevent erosion being either inadequate or were adopted too late to be of full value.

Amongst the more important recommendations of the Committee are to be noted the universal use of cover crops; further research work; education and propaganda by lectures and through school gardens; and certain precautions to be observed in alienating Crown land for development. An appointment of an extra staff officer on soil erosion is recommended, besides facilities to enable the present field officers of the Department of Agriculture to keep abreast of all developments of the subject.

The Report leaves one with an impression that Ceylon planting politics are less advanced on this subject than are Malayan. It may be that this is erroneous and is caused by the fact that the Committee was naturally impressed by the damage done and the desire to see an improvement effected. The Report will focus attention on a serious problem which applies to Malaya as well as Ceylon. The Ceylon Committee appears confident that sufficient improvements can be brought about if their recommendations are put into practice, for they are adverse to the introduction of legislation to effect their purpose. But they add, "that after educative methods have been tried for a limited period, or, if the present depression continues for seven years, the subject should be brought up for review on the understanding that, if conditions are still unsatisfactory, compulsion by means of legislation should be further considered".

D. H. G.

Administration Report of the Royal Irrigation Department of Siam 1914-1926.

219 pp. Illustrations and maps. Bangkok Times Press Ltd., 1927.

In view of the desirability of extending and improving the rice-growing areas in Malaya, the above report, although published five years ago, is of increasing significance. It provides a record of the successful development of rice-cultivation in Siam which should be of great value in the development of similar schemes elsewhere.

This report opens with an introductory note explanatory of the events which led to the re-establishment of the Royal Irrigation Department.

The rainfall in the main rice producing districts in Siam is only about 41½ inches per annum whereas the rice crop is reckoned to require some 72 inches in its growing season (6 months). In years of good rainfall the de-

ficiency is made up by the rivers spilling over the banks, but in years of scanty rainfall, or rainfall coming at the wrong time, the rivers, unassisted, do not rise sufficiently to provide for satisfactory inundation and the crops suffer proportionately.

The problem of stabilising, increasing and improving rice production in Siam has always been given much consideration though the first tangible attempt to control irrigation for the crop was made only forty years ago by the formation of the Siam Canal, Lands and Irrigation Company.

This Company obtained a large concession (Rangsit) of land, dug a series of canals and constructed certain locks and sluices with the object of conserving available water supplies for use in times of scarcity, rather than to provide irrigation in the true sense. Briefly, these canals, completed in 1896, were simply inundation canals merely serving the purpose of intercommunication, and on silting up, many became useless. The Concession brought under cultivation some 350,000 acres of excellent land, but only 40 per cent. of the area matured crops each year so that the high hopes of increased productivity were not realised. The inherent defects of the scheme were soon evident and the Concession lapsed to Government in 1915 and was taken over by the Royal Irrigation Department.

In 1899, the Minister of Agriculture, after a tour of inspection of the Rangsit Concession, suggested the appointment of an hydraulic engineer as an adviser to that Ministry. His late Majesty King Rama V graciously approved the proposals, and eventually Mr. J. Homan van der Heide, of the Netherlands East Indies, was appointed first Director-General of the Royal Irrigation Department. The series of locks and sluices projected by Mr. van der Heide added materially to the prosperity of the southern portions of the central plain, but financial exigencies prevented the materialisation of any of his main projects before he left Siam in 1909.

Two very dry years 1909—1911 compelled the Government to reconsider measures for improving the water control for the rice crop, and consequently a Commission was appointed to devise the best means towards this end, and on that Commission's report the Minister of Lands and Agriculture was instructed to prepare irrigation schemes.

With this object, Mr. Ward (now Sir Thomas), together with a Staff of his own selection, was recruited from the Indian Irrigation Service to solve the problem in Siam. Thanks to the mass of preliminary data available through the efforts of Mr. van der Heide, Mr. Ward completed a series of projects for the irrigation of almost the whole central plain of Siam within 18 months and then returned to India, while his chief assistant, Mr. R. C. R. Wilson, was appointed Director of the resuscitated Royal Irrigation Department.

The results of Sir Thomas Ward's investigations were published in four volumes, and his report showed that he had arrived at the same conclusion as Mr. van der Heide, namely that the possibilities of scientific irrigation in Siam were very good and that great benefits should accrue therefrom.

He was of opinion that irrigation developments in the country should be gradual and sure without going ahead of natural demand, and experience to date has justified his opinion. His idea of development embraced five distinct projects which would eventually be linked up into one comprehensive scheme protecting the whole of the central plain and mainly dependent on the waters of the Menam Chao Phya for its supply.

The Government of Siam decided to begin work on the Prasak South Canal in 1915 and immediately set about expropriating the necessary land for the head work and main canal and the selection of the site for the head works. Suitable compact limestone for the construction of the barrage was located conveniently and the Prasak river itself yielded sand suitable for cement mixing to produce a satisfactory mortar. The use of machinery, on the grounds of economy, was advocated, and two drag line excavators of American design were ordered, each being capable of digging 4½ cubic metres of earth at one cut and having a swinging radius of 28 metres. These two excavators were so successful that two more were ordered. Other important machinery included a suction cutter dredge, a large steam shovel (used exclusively for digging the pit for the construction of the barrage and head works), a small steam shovel, locomotives, steam hauling winch, stone crushing plants, tip waggons, light rails, concrete mixers, pile drivers, locomotive crane, and general contractor's plant. The head works of the canal system, in addition to the necessary excavations and the construction of a dam to close the old channel of the river, consist of a barrage of six spans (each of 12.5 metres), a head regulator, a lock to pass boats, a lock leading from the river to the canal and bridges for traffic across the new channels. The Report (with photographs) describes each of these structures in detail and gives the quantities of materials used, details relating to the working of the various machines and details of the costs (over £1,180,000) of the works which were completed (in 1924) after 6½ years. The project affected directly 240,000 acres and indirectly affected the whole of the Rangsit Concession and was capable of expansion to a much larger area by the extension of the distributaries as required.

Further sections of the report deal with the progress of other irrigation and drainage works embracing six separate schemes estimated to cost over £2,350,000 towards which the Ministry of Finance recommended an expenditure of £224,000 per annum commencing in 1923. These reports of progress indicate the importance which the Siam Government attaches to the problems of irrigation as affecting the main food crop and wealth-producing asset of the country and might well be imitated in Malaya on a proportionate scale.

The report contains weather, water supply and meteorological data which are of considerable interest, and a chart shows that the production of padi per acre follows fairly closely the maximum height of the river on the Ayuthia gauge and that the total production of rice tends to increase annually. The concluding sections of the report deal with works carried out in the central workshops,

and various lists of machinery, stores, dredging plant, buildings, etc. The report is of interest to the agriculturist, the hydraulic engineer and the administrator and forms a compendium of very useful information especially for irrigation engineers.

H. W. J.

SISAL UND ANDERE AGAVEFASERN.

(Sisal and other Agave fibres).

BY

Dr. Fr. Tobler.

120 pp., 44 illustrations. Deutscher Auslandverlag Walter Bangert.

Berlin, 1931.

The author, although not claiming to be a planter, is of opinion that the practical man may find useful these personal experiences in East Africa as well as in Yucatan, Mexico.

Botanical information of the sisal plant, its distribution and export statistics form the subject matter of the first chapter. The second chapter explains and compares the difference in the quality of fibre from various species and countries and from plants of a common species at different ages.

Subsequent chapters treat with the subjects of cultivation, estate practice; cropping, fibre extraction, cleaning, curing and marketing; spinning; uses of the fibre, fibre products and literature.

Particular interest attaches to the chapter which describes the method of selecting and collecting the leaves and of the machinery used in the various processes. This section also gives a brief summary of the gradual development of the methods of mechanical treatment with a comparison of the merits and demerits of the various types of machinery. Special attention is given to the causes of subsequent discoloration of the fibre and to the means for its prevention. Utilization of the waste in the manufacture of by-products is described and further possibilities are discussed.

For those familiar with the German language (the Roman character is employed) this little book will prove of great interest. The text is assisted by the many excellent illustrations which give a comprehensive idea of the botanical features of the plant, estate conditions and practice, mechanical and other procedure, and machinery.

L. A. J. R.

Miscellaneous Articles.

THE EIGHTH MALAYAN EXHIBITION.

The eighth Malayan Exhibition, organised by the Malayan Agri-Horticultural Association was held at Kuala Lumpur on the first three days of August 1931.

The weather on the first two days was fair and 21,000 people visited the Exhibition. On the final day, however, rain fell steadily during most of the day and seriously effected the attendance. The official return of attendance for the duration of the Exhibition is 24,139.

The Exhibition was opened by His Excellency the Governor and High Commissioner, Sir Cecil Clementi, G.C.M.G. The ceremony was also graced by the presence among others of His Highness The Sultan of Selangor and His Highness The Yang de Pertuan Besar of Negri Sembilan.

In his speech, His Excellency drew particular attention to the value of some of the minor crops of Malaya and of the possibilities that existed for developing their production. In addition he gave his views on the recommendations contained in the recent Report of the Rice Committee and stated that while action had already been taken to put some of the recommendations into practice others required his further consideration especially those that would entail large financial provision.

The Agricultural Show was divided into a number of sections, each of which was managed by a section Chairman assisted in some cases by a sub-committee. The sections were :– Vegetables, Fruits, Oils and Fats, Rubber, Cereals, Fibres, Preserved Fruits and Confectionary, Poultry, Pigs, Cats, Horticulture. The non-agricultural sections were :—Village Industries, Weaving and Needlecraft, Malay Schools, Art and Photography, and Trades.

The following institutions and Government Departments staged special exhibits :—Department of Agriculture, Rubber Research Institute of Malaya, Fisheries Department, Public Health Education and the Town Planning Department, while the Co-operative Societies Department with other Departments gave nightly displays of educative cinema films. The Rural Lecture Caravan, organised by the Departments of Agriculture and Co-operation with the Rubber Research Institute, was on view.

Space forbids anything but a cursory review of the exhibits in the numerous sections. The exhibits in the competitive sections were perhaps fewer than usual, but greater care had been exercised in their display. In particular, care had been taken to obtain stronger competition in the more important of Malaya's minor agricultural industries. The exhibits of canned pineapple, for instance, formed the most representative display yet seen at these Exhibitions, while the sample of palm oil from Elmina Estate, which won the Governor's cup, was stated by the Judge to be the finest sample analysed by him and fully equal to that produced commercially in any part of the world.

The Cereals Section contained a large number of samples of padi and rice drawn from most of the padi-growing districts of Malaya. An increasing number of samples originating from selected seed derived from the Government

Padi Stations is seen each year at these Exhibitions. The section is a centre of interest for the more critical Malays who may be seen examining the prize-winning samples for comparison with their own non-successful exhibits.

The fruit exhibits were rather disappointing. It is doubtful whether the Exhibition offers any great inducement towards the cultivation of better fruit. It is certain that the more attractive exhibits are purchased for seed purposes—His Highness the Sultan of Selangor was observed to set an example in this respect—but the quantity so utilised is little, while the need of improvement in this respect is great. It is hoped that on future occasions an attempt will be made to offer good stock for sale and to demonstrate the methods advocated towards the propagation of improved fruit.

The Vegetable Section was more representative of the best in the country, some of the Chinese exhibits calling for particular attention.

A special feature of the exhibits staged by the Rubber Research Institute was a large working model of the new Cascade sheeting battery and model tanks and other factory appliances to complete the equipment of a model miniature sheeting factory.

The Village Industries and the School Industries Sections commanded considerable attention. The exhibits were very numerous and sales were most encouraging. There is still a tendency amongst villagers to spend considerable time on making articles that have little or no utility, but it is noted that at each successive exhibition greater regard is given to the production of useful articles.

The section also included Malacca and Port Dickson basket work, Brunei silverware and work from the Kuala Kangsar Art School. A small section was also devoted to work from the Decrepit Asylum and was in charge of three blind inmates.

The School Industries section deserves special praise. The basket work was decidedly good and sold readily, while the special display from a Johore school, which included working models and carpentry was of great interest.

The Pig Show was the largest and most instructive yet staged at these series of Exhibitions. In addition to pure bred and cross bred pigs from the Government Experimental Plantation, Serdang, which were not for competition, other exhibitors shewed pure bred animals, some of which were not competing for prizes. In comparison, many of the local breed of pigs appeared poor specimens and thus provided a valuable object lesson on the possibilities of improvement of this important local industry.

A similar object lesson was provided in the poultry section. Sales were good, from which can be inferred that poultry keepers are becoming increasingly alive to the importance of introducing better strains in their runs.

An effective display was made in the Horticultural Show, which by reason of transport difficulties is practically confined to exhibits from around Kuala Lumpur.

The trade stands were on a less lavish scale than usual and were fewer

in number, but most of the big firms were present and attractively demonstrated the services they had to offer to local agriculture. The prominence, for the first time, of firms selling fertilisers was noticeable and it was also observed that the native agriculturist—in particular, the Chinese market gardener—was interested in these products as he is becoming more fully alive to the possibilities of employment of artificial fertilisers in his vegetable garden.

An inovation this year was the Fisheries Exhibit, staged by the Fisheries Department. The Department devoted most of its space to exhibits designed to encourage the development of fresh-water fisheries in Malaya. The article which appears in another part of this number of *The Malayan Agricutural Journal* will give some idea of the importance of this subject and the scope it offers for display at the Exhibition.

The work of the Health Department was adequately demonstrated in the Health Pavilion, where full use was made of models to illustrate the measures which are recommended to ensure the health in the home and on estates. The Infant Welfare section of this exhibit daily attracted a large crowd who could hardly fail to be impressed by the numerous exhibits and the recommendations that were rendered obvious by the excellence of the models.

Considering the Malayan Exhibition as a whole, one realises with satisfaction that the various workers concerned had this year given greater attention to improving the method of display and in demonstrating by means of models, the lessons they wished to drive home.

The Malayan Agri-Horticultural Association, by means of paying a certain number of railway fares, ensured that representative Malays from all parts of the country should see the Exhibition to enable the propaganda work of this event to be carried back to the more remote villages in the country. This, though perhaps a considerable drain on the resources of the Association, is an excellent system as it results in the certain dissemination of knowledge gained at the Exhibition over practically the whole of Malaya.

RUBBER AT THE MALAYAN EXHIBITION.

BY

B. J. EATON, O.B.E.,

Director, Rubber Research Institute of Malaya.

Rubber Section

The Malayan Agri-Horticultural Exhibition 1931.

In spite of the short period available for organisation and the present slump conditions in the industry, the Rubber Section of the Malayan Exhibition 1931 may be described as a success both in relation to the competitive exhibits and the educative and propaganda exhibits staged by the Rubber Research Institute.

A majority of the members of the Committee of the Rubber Section was at first opposed to the idea of any competitive exhibits from estates, but at the request of the Chairman decided to waive their objection provided the Chairman obtained definite promises of not less than 75 exhibits.

The Chairman circularised about 2,000 estates, including both European and Asiatic properties and obtained promise and support from 60 estates, together with one exhibit of locally manufactured rubber articles.

In addition, exhibits of smoked and air-dried sheets from small holders and an excellent collection of smoked sheets prepared by members of Co-operative Societies were received.

Although the total number of exhibits from large estates was disappointingly small, the response was better than was anticipated.

The exhibits from large estates included 50 samples of smoked sheet which were almost all of excellent quality, while many of the small holders' exhibits of smoked sheet were equally good.

Sole crepe was unfortunately conspicuous by its absence, while only two samples of pale crepe and 13 samples of lower grade crepes were exhibited.

Prizes were awarded by the judges as follows :—

	Smoked Sheet	*Pale Crepe.*	*Compo Crepe.*	*Scrap Crepe.*
1st Prize.	Sungei Tua Estate	F.M.S. Rubber Co., Kajang	Bungsar Est. (Socfin Ltd.)	Bungsar Est. (Socfin Ltd.)
2nd Prize.	Labu Estate	Changkat Salak Estate	Bujong Est.	
3rd Prize.	Nagalelai Estate		F.M.S. Rubber Co., Kajang	
Highly commended	Sungei Rambai			

It should be mentioned that all exhibits were selected at random from estates by Agricultural Officers and planters who were good enough to offer their services for this work, so that all exhibits were genuine commercial samples and not specially prepared for the Exhibition.

Only one firm, Messrs. Tan Kah Kee & Co., sent exhibits for competition in the class for locally manufactured rubber articles. The collection of articles from this firm was very representative and attractive and was awarded the first prize.

The attractive character, particularly of the footwear, combined with the low price of the articles shows clearly why this firm is able to compete so successfully with European and American rubber manufacturers.

A very attractive range of Cressonite rubber flooring and wall tiles was also presented to the Rubber Research Institute for exhibition by the Singapore Rubber Works. These tiles which are manufactured under the Cresson patents consist of a thin rubber layer of various attractive designs on an asbestos-cement composition and can be laid in the same manner as concrete tiles.

If these tiles can be manufactured at a competitive price they should find a rapid and extended use in all buildings. In addition specimens of Cresson Roadway blocks were exhibited, including one block which was laid in 1922 outside the Singapore Harbour Works and removed in 1928. The rubber cap on this block shows little sign of wear after 6 years' heavy service and only slight surface "cracks" caused by the effect of strong sunlight. An experimental piece of roadway with these blocks has also been laid down in London.

Mention might also be made here of the Gaisman rubber capped roadway blocks exhibited in the Trades Section by Harrisons, Barker & Co. Ltd.

The Rubber Section is also indebted to the Dunlop Rubber Company for the loan of a show case containing a collection of rubber articles manufactured by this well known British firm.

The articles of special interest in this collection were the sponge rubber seat of cars, rubber bicycle seats, a rubber truncheon for policemen, and a rubber headed mallet for fitters. An exhibit showing the various constituents used in tyre manufacture was also instructive.

Air-Dried Sheet.

Owing to the fact that the present market demand for air-dried sheet is limited, it was decided not to include this in a class for competition.

The Rubber Section and the Rubber Research Institue are, however, indebted to the Socfin Co. Ltd., Selangor, and Kamuning Estate, Perak, for excellent exhibits of this grade, which represent commercial samples exported from Malaya.

Kirby Estate (Labu) also exhibited (not for competition) an excellent range of coloured sole crepes and ordinary sole crepe.

An interesting sample of crepe prepared from air-dried sheet clippings was also exhibited by the Socfin Co. Ltd.

Rubber Research Institute Exhibits.

A comprehensive series of exhibits were staged by the various Divisions of the Rubber Research Institute. The main object of these exhibits was

educative and to illustrate some of the principal activities of the Institute in relation to improvements in estate practice.

Chemical Section.

Special mention must be made of the miniature working model illustrating a proposed ideal lay-out for a central sheeting factory. The model of the five sheeting machines in Cascade formation was constructed by the Federated Engineering Co. Ltd., Kuala Lumpur, and the firm is to be congratulated on this excellent model. This battery was operated by a small 1 H.P. motor.

All the remaining equipment in this factory, including ramp for lorry tank, straining trough, settling and bulking tanks, straining tank, water supply pipes. trough for distribution of latex, coagulating tanks of various designs, chute for conveying coalgulum to the sheeting machines and between each machine, soaking tank and rack on wheels for smoking and drying rubber on the flat was constructed by the well known Swiss firm of Diethelm & Co., Singapore, who were also responsible for the complete lay-out.

Messrs. Schweizer and Schmid of this firm were in attendance during the whole period of the Exhibition in order to give advice and demonstrations.

The advice and assistance rendered by these representatives of the firm were much appreciated by visitors.

It might be mentioned here that, although the Institute is aware that it is not possible at this time for most estates to re-organise their factories on the lines proposed, there are a number of ideas embodied in the lay-out which can probably be adopted. The main object, however, of the model is to emphasize that central factories on the lines shown should be the aim of the plantation rubber industry.

A factory with a similar lay-out is already in existence on one estate in Malaya and the output amounts to 1,500 lbs. of dry rubber per hour, which can be increased to about 1,700 lbs. per hour.

Planters will also be interested to know that this model has been presented to the Institute and will be available at all times to visitors who are interested.

A number of other appliances and apparatus suitable for rubber estate factories, including the new all-aluminium tank were exhibited by this firm.

Other aspects of Rubber Estate factory problems in the preparation of rubber were demonstrated by the Chemical Division of the Institute by means of, (a) defective specimens of sheet and crepe rubber specially illuminated to show these defects, (b) photographs and diagrams.

The importance of settling and straining latex for the preparation of sheet rubber was demonstrated by means of exhibits and photographs.

Another exhibit in the Chemical Section, which attracted considerable attention, was the small drying chamber heated by means of low-voltage electric current with sheets laid flat on racks to effect economy in drying space,

A few of the important non-constituents separated from rubber latex, viz: quebrachitol, protein and lipin substances were exhibited.

Botanical Section.

The budding of Hevea rubber was illustrated by the Botanical Section by means of an excellent series of enlarged photographs, showing the sequence of operations and also by anatomical specimens. Budding demonstrations were also arranged at four periods during each day of the Exhibition.

In addition, a series of young plants of well known clones were exhibited in order to illustrate some of the important vegetative characters by means of which many of these clones can be identified.

Pathological Section.

The Pathological Division concentrated chiefly on Root disease of the rubber tree and staged an excellent collection of material illustrating the most important root diseases (Fomes lignosus and Fomes pseudoferreus) and their method of spread and treatment.

Detailed printed narratives attached to each exhibit enabled interested visitors to obtain information on these diseases. Photographs and drawings were also displayed to supplement the specimens.

Another important exhibit in this Section consisted of two tanks with glass sides, demonstrating the growth of Fomes lignosus in soils and illustrating in one tank that an application of as much as 4 tons of lime per acre was ineffective in preventing the growth of the mycelium of this fungus in the soil.

Exhibits were also staged to demonstrate the effect of die-back caused by weak parasitic fungi on wounds or cuts made in pruning, when suitable wound dressings are not applied. The satisfactory results obtained by the use of asphalt-kerosene mixtures as recommended by the Institute were also demonstrated.

Soils Section.

The Soils Division concentrated on a valuable but technical exhibit, showing the main classification of soils on a climatological basis. The collection included a large series of rubber estate soils examined at the Institute, a collection of the principal nitrogenous, potassic and phosphatic fertilizers used on estates and graphs illustrating the effect of the application of fertilizers on Malayan rubber estates.

Publications.

A Publication Stall completed the exhibits staged by the Rubber Research Institute.

Since the ordinary publications of the Institute are circulated free to all estates in Malaya, it was not anticipated that there would be much demand for these. The revised sets of Information Cards on the preparation of and defects in raw rubber, however, were in considerable demand.

General.

Judging from the remarks made by planters and other visitors to the Rubber Section and letters since received, there is little doubt that this Section, in spite of present conditions, proved an unqualified success and was of considerable educative value.

CONDITIONS IN SMALL RUBBER HOLDINGS IN MALAYA.

Second Quarter, 1931.

The Weather.—Normally the second quarter of the year is a period of fairly heavy rainfall over the greater part of the Peninsula. In respect of total rainfall the period under review departed little from normal conditions, but the heavier precipitation appears to have been towards the end of the quarter rather than, as is more usual, at the beginning. A very wet June was experienced generally this year, whilst in April and May the rainfall seems to have been generally slightly below the average. Even the West Coast stations appear to have shared in the heavier June precipitation, an exception being Port Dickson where dry weather was reported for the month.

Prices.—Local prices have been lower than during last quarter. Reports of prices paid to small holders for their rubber reveal the great range noted last quarter, but without any noticeable monthly variation. Thus, in cents per kati, the range for smoked sheet was from 8 to 14 cents and for unsmoked sheet from 5 to 13 cents. Prices for scrap and lump still show the great range of from 2 to 7 cents. The equivalents in cents per pound are:—

Smoked Sheet	6	to	$10\frac{1}{2}$	cents.
Unsmoked Sheet	$3\frac{3}{4}$	to	$9\frac{3}{4}$	cents.
Lump and Scrap	$1\frac{1}{2}$	to	$5\frac{1}{4}$	cents.

The monthly average Singapore prices for standard smoked sheet were:—

April	9.7 cents per lb.
May	9.1 ,, ,, ,,
June	9.5 ,, ,, ,,

General.—The tendency noted last quarter for small-holders to turn their attention to crops other than rubber, has become more marked during the period under review. As the change over is almost entirely to food crops, it indicates that a number of Asiatics realise that, under present conditions, it is necessary for them to produce food for themselves, as they are not in a position to continue to buy it as they have been in the habit of doing in the past. Thus, although the matter may be of some possible importance as regards the economics of the small-holder, it has little to do with economics of rubber excepting that it may temporarily reduce outputs to a small extent owing to the cessation of tapping whilst owners are engaged on planting food crops.

The area out of tapping has considerably increased during the quarter. This is mainly due to increased activities in preparing land and planting the padi crop. It is estimated that in Negri Sembilan some 5,600 acres of small holdings are out of tapping and that in Province Wellesley about 70 per cent. of the small holdings are closed down, the figure for Penang being approximately 80 per cent.

Investigations.—During the quarter a scheme for obtaining information regarding the bark consumption, bark reserves, bark renewal and yields of small holdings was decided upon after discussion between the Rubber Growers' Association, the Department of Agriculture and the Rubber Research Institute. A grant of $10,000/- has been made from the Rubber Experiment and Research and Propaganda Fund and placed at the disposal of the Director of Agriculture for the purpose. The scheme provides for taking monthly measurements on one hundred selected representative small holdings, situated throughout Malaya. At the end of the quarter final details have been worked out and decided upon and everything is in readiness for selecting the holdings to be used, and for first measurements and records to be made. It has to be admitted that reliable information as regards the capabilities of rubber under small holding conditions is almost entirely lacking. Statistics clearly indicate that general ideas on the yields of small holdings that obtained in pre-restriction days were very far removed from actual facts. It is no less possible that common present days views on the questions of bark consumption and renewal, and bark reserves on small holdings, may be just as far removed from the truth.

It is hoped that the scheme decided upon will, after the course of twelve months, place at our disposal sufficient information to provide a basis for calculation, instead of the matter being one largely of pure conjecture as it has been in the past.

Disease.—(a) *Oidium leaf mildew.* Further cases were reported from areas in Malacca and Negri Sembilan in April, but the outbreak was both less severe and less protracted than the similar outbreak which occurred over the same area at a similar time last year.

(b) *Mouldy Rot.* The wet weather resulted, as usual, in increased activity of the fungus causing this disease. Control was fairly satisfactory in most areas, although the difficulties of inducing small-holders to carry out really effective treatment are greatly intensified by the present economic conditions.

Departmental.

FROM THE DISTRICTS.

The Weather.

Over the major portion of the Peninsula the rainfall for the month was above the average and was generally evenly distributed. At most of the inland stations figures are well in excess of the recorded mean for the month and this applies to many of the West Coast Stations, although in some of these the figures approximate more closely to the normal and, in a few cases, are slightly below average.

Remarks on Crops.

Rubber.—Prices paid by local dealers to the small-holders are very slightly below those for last month. The following quotations are the prices per pikul. Smoked sheet, from $8 to $13 : unsmoked sheet, from $7 to $11 : Scrap, from $2 to $6. In Krian district of Perak a considerable quantity of slab rubber is prepared in a somewhat crude manner and realises from $6 to $7 per pikul, most of it being bought by dealers in Penang. A much smaller amount is prepared also in Larut district.

Good progress has been made in selecting holdings for investigations regarding bark consumption, bark reserves and yields on small holdings. Most of the holdings considered necessary for the purpose in the Federated Malay States and Straits Settlements have been selected and the trees have received the preliminary marking, preparatory to the first records being taken.

The unusually wet weather experienced has resulted in continued activity of the Mouldy Rot fungus. Efficient control on small holdings is becoming increasingly difficult as the poorer owners are very reluctant to spend money on the fungicides required and the presence of undergrowth in many holdings provides conditions particularly favourable to the growth of the fungus.

Padi.—Planting of the crop is practically complete in Negri Sembilan (except Kuala Pilah District) and the inland Districts of Malacca and Selangor. Elsewhere, preparation of land is progressing under favourable conditions. Some delay in cultural operations has been occasioned by excessive water in parts of Malacca.

In Malacca the Department sold approximately 8 tons of Perlis Guano to cultivators at the cost price of $1.10 a pikul. It is being tried as a substitute for bones in the "chelup" mixture. "Chelup" refers to the Malacca custom of dipping the roots of young plants in a wet manurial mixture before planting. The great demand for Perlis Guano is occasioned by its present low cost as compared with the price of bones.

Tobacco.—Interest in this crop is well maintained. The area in Province Wellesley now totals about 50 acres. The Rangoon type imported into this

Settlement is making good growth and looks very promising but, harvesting not yet having taken place, it remains to be seen whether the type will provide a suitable leaf for the local market. The highest price obtained for cured leaf during the month was $45/- a pikul. Interest in the crop is newly reported from Pahang and there is some prospect of a further area of 6 acres being opened at Port Dickson.

Agricultural Stations and Padi Test Polts.

Province Wellesley.—The Scraup varieties of padi have received their first transplantation at Bukit Merah Padi Station and these and other similar long maturation varietes have been sown at Glugor. The trials at Glugor with short season varieties during the intercrop season are proving a failure. Two varieties are fruiting, but birds eat the grain as fast as it is produced and, notwithstanding all efforts to prevent it, rats continue to do damage.

Perak.—(a) *Agricultural Stations.* At Selama the area has been demarcated and reservation applied for. A lay-out has been decided upon and material ordered for planting. Steps have been taken for the erection of buildings. At Kuala Kangsar some tobacco was harvested and is being cured. Wet weather has interfered with this operation. Of the varieties in the field, the local Chinese type and a Virginia variety "Hickory King" are doing well, whilst variety "Joyner" is making very poor growth and is apparently unsuited to the conditions of the station. Groundnuts are doing well but the departmental hybrid' local maize is making poor growth. Seedling oranges are being raised as stock for budding.

(b) *Padi Test and Experimental Plots. Selinsing.* Cultivation was completed early in the month. Plants have received one transplantation. *Bukit Gantang.* Preparations for opening this new Test Plot and planting it are complete. *Kamunting Slimed Area.* Nurseries of the Seraup strains have been sown. Tuba root has been placed in the irrigation channels with the object of controlling *Nymphula depunctalis,* a semi-aquatic leaf-eating caterpillar.

Selangor.—Cheras Station. Survey has now been completed and a fencing contract made. Plants are making good growth on both Kuang and Kajang Padi Test Plots. There is less evidence of stem borer damage on the Kuang plot.

Negri Sembilan.—Rembau Station. Preliminary cultivation of the whole area is under way and arrangements have been made to disc harrow later. *Seremban Station.* Late crops of Oranges (Valencia Late) have suffered much less damage from the fruit fly than did earlier crops. A good crop of Salisbury White maize was harvested. *Rembau Padi Test Plot.* Nurseries were sown. Some damage was done by birds to two varieties which necessitated resowing.

Pahang.—(a) *Agricultural Stations. Kuala Lipis.* Plots of Maize and Groundnuts were harvested. *Temerloh.* Rain has delayed burning the felled jungle. Posts have been prepared for fencing. *Kuantan.* An amended lay-out

was approved and work on draining has been put in hand. *Pekan.* Yam and Sweet Potatoes were planted and the fruit area cleaned up preparatory to planting a cover crop.

(b) *Padi Test Plots. Dong.* Ploughing and harrowing is in progress. Plants in the nurseries are making good growth.

Tenders have been invited for the erection of a store.

Temerloh.—Planting is delayed as some plants are not large enough to stand transplanting into the deep water present on some parts of the plot. The planted area is doing well.

Pekan.—Stem borer damage has been noted in the area planted up.

Malacca.—Burning off has been delayed by rain on the Sungei Udang Station. At Pulau Gadong Station, nurseries have been sown for the checker-board and multiplication plots and transplanting of the ear-to-row selections is in progress. At Alor Gajah Test Plot the transplanting of the earlier sown varieties has been completed.

Kedah.—Good progress was made with the preparation of land for planting at Telok Chengai Padi Station, as well as at Padi Test Plots at Rantau Panjang, Jitra, Langgar and 17th mile, Sungei Patani Road. The lay-out and planting programme for these Test Plots has been formulated.

DEPARTMENTAL NOTES.

The Malayan Exhibition.

The annual exhibition organised by the Malayan Agri-Horticultural Association provides an opportunity of bringing the public more closely in touch with the work of the Department of Agriculture. In past years the event has enabled the Department not only to demonstrate particular crops or agricultural products of Malaya, but to shew the scope of recent work of the Department. A departure from this system was made at the Malayan Exhibition, held at Kuala Lumpur from August 1st to 3rd for the Departmental exhibits were confined to relatively a few subjects in order that they might be treated more thoroughly and leave a deeper impression than would a collection of exhibits of a diverse nature.

Pride of place amongst the exhibits was given to food products, shewing those that are suitable for cultivation in the lowlands and those more suited to the highlands of Malaya. In some cases, the various stages of production were shewn, such as the growing plant, the raw and the commercial product. In view of the dependence of Malaya on imports of almost all foodstuffs, these series of exhibits were of great importance and roused keen interest.

Considerable investigations have been undertaken during the past few years towards improving the yielding capacity of local varieties of rice and of adapting varieties to the differing local conditions encountered in the country. An exhibit illustrative of the results of this work is now an annual feature of the Departmental exhibit and never fails to attract the attention of the large number of Malay small-holders who visit the exhibition.

Other prominent features of the exhibits staged by the Department were concerned with coffee and lowland tea.

The Department has investigated the local demands regarding quality of coffee with a view to supplying the needs of the country by local production. Samples of coffee grown at Serdang were shewn as fulfilling these local requirements. The Entomologist staged an exhibit illustrative of the Coffee Berry Borer and demonstrating how the serious damage by this pest may be obviated. A sample of Arabian coffee grown at the Government Experimental Plantation, Cameron Highlands also attracted much attention.

The erection recently of a tea factory at the Government Experimental Plantation, Serdang made it possible for the Department to shew the commercial product, which has been manufactured on the Plantation. Furthermore, living specimen tea plants of different "jats" grown at Serdang, most of which had reached the bearing stage, were exhibited.

A very fine samples of cloves grown at Serdang was shewn and is worthy of mention, especially as it refutes the general impression that this plant will only thrive within sound of the sea.

The English, Malay and Chinese publications of the Department were

displayed for sale, while officers conversant with these three languages were present throughout the duration of the Exhibition to deal with enquiries of an agricultural nature.

Poultry for Fraser's Hill.

A consignment of poultry, comprising 5 White Leghorns, 6 Rhode Island Reds and 6 Light Sussex has been received from South Africa. One White Leghorn hen died on the voyage, but the remainder arrived at Fraser's Hill in good condition and are excellent specimens of the breeds they represent.

Publications.

Two special Bulletins of the Scientific Series have recently been published. They are:—

No. 5. The Bionomics of some Malayan Rhynchota (Hemiptera-Heteroptera) by N. C. E. Miller. Price $1.

No. 6. Stem-Rot of the Oil Palm in Malaya by A. Thompson. Price 50 Cents.

These publications will be reviewed in a subsequent number of this Journal.

The second quarterly number of the Chinese Agricultural Journal of the Department was published in June. It contains special articles on Rat Destruction in Malaya and on the Quality of Copra.

Staff Changes.

Mr. F. R. Mason, returned from leave and resumed the duties of his appointment as Agricultural Field Officer, Penang & Province Wellesley on the 15th July, 1931.

Mr. H. J. Simpson to act as Agricultural Field Officer, Selangor, from 15th July, 1931.

Raja Mohamed bin Raja Aman to act as Agricultural Field Officer, Perak South, from 15th July, 1931.

Statistical.

MARKET PRICES.

July, 1931.

Rubber.—The Singapore spot price of Ribbed Smoked Sheet rubber equal to London Standard stood at about 10½ cents per lb. during the first week of the month, thereafter gradually declining until the price reached 8¾ cents at the end of the montth. The average Singapore price for the month was 9.7 cents per lb. as compared with 9.5 cents per lb. for June. The average London price was 3d. per lb. which was also the average price throughout May and June.

Palm Oil.—Prices shew little change. Latest information received during July quote July/August Shipment C.F.I. London @ £16.5.0.

Copra.—Prices have declined, but Singapore values have been relatively high due to the demand of local mills. Supplies are heavy. Sundried copra opened at $5 per picul and for a short time stood at $5.30 per picul. The price then declined, closing at $4.25 per picul. The average Singapore price for July was $4.70 per picul for "Sundried", "Mixed" being 25 cents per picul below this price. The average Singapore prices for June were $4.23 per picul for "Sundried" and $3.99 per picul for "Mixed". Copra remains around $1.75 per picul.

Gambier.—Prices have appreciated slightly, at the end of the month "Block" being quoted at $10 and Cube No. 1 at $19 a picul. Average prices were; Block $9.50; Cube No. 1 $18.80.

Rice.—The average declared trade value of imports of rice into Malaya for the month of June was $3.67 per picul compared with $3.83 per picul for May.

The average retail market prices per gantang of No. 2 Siam rice in June were:—Singapore 30 cents, Penang 28 cents, Malacca 25 cents. The corresponding prices for May were 32,38 and 35 cents per gantang respectively.

Arecanuts.—Palembang Whole averaged in Singapore $4.17 per picul during July, mostly purchased for the Hongkong market. The average price for this grade in June was $3.82 per picul. Bila Whole averaged $3.64 per picul in July as compared with $3.50 in June. For other grades, the average prices ranged as follows:—Sliced $5.55 to $13.62; Red Whole $6.19 to $8.00; Split $3.66 to $6.09; Kelantan Split $5.85 to $6.15, the price within each range depending on quality. The cheaper priced Sliced and Red Whole have found a slightly improved market in India, while the higher qualities have been saleable in the Annam market.

Coffee.—Owing to small arrivals of the best quality of Java Robusta, prices improved somewhat but declined towards the end of the month. The Singapore prices of Java Robusta averaged $17.62 to $19.06, as compared with $16.87 to

$18.94 per picul in June, the price within the range in each case depending on quality. The average price during July for Palembang coffee was $12.79 per picul as compared with $12.87 for the previous month.

Pineapples.—Business is now small and the market dull. Average prices per case for July were:—1½ lb. cubes, $3.48; 1½ lb. sliced flat, $3.35; 1½ lb. sliced tall, $3.51. Corresponding prices in June were $3.50; $3.36; $3.37 respectively.

Tapioca.—Moderate transactions are reported, but prices sagged at the end of the month. Average prices per picul were:—Flake fair, $3.47; Pearl, seed, $4.43; Pearl, medium, $5.00 as compared with $3.19; $4.19 and $4.90 respectively in June.

Sago.—Market for sago flour is quiet but steady with moderate business passing. Average prices per picul in July were as follows:—Pearl, small fair $4.39 as compared with $4.49 in June; Flour, Sarawak fair, $1.84 as compared with $1.78 in June.

Pepper.—Prices remained firm until heavy arrivals of the new crop of Muntok which resulted in some pressure to sell on the part of importers and consequent lower prices. Average prices per picul in July were:—Singapore Black, $19.20; Singapore White, $30.80; Muntok White, $31.45. Corresponding prices in June were $18.12; $29.75 and $30.75 respectively.

Cloves.—Zanibar cloves dropped from $50 to $43, the average for the month being $46.60 per picul as compared with $52 in June. Amboina cloves dropped from $52 to $48 per picul, the average price for July being $49.40 as compared with $56 per picul in June.

Mace.—The high prices realised at the beginning of July were not maintained, the demand now being poor and the market still shewing a downward tendency. Siouw fell from $70 to $49, the average for July being $56.10 per picul as compared with $51.75 per picul in June. Amboina started the month at $47 but fell to $33, the average price for July being $39.30 per picul as compared with an average of $38.12 in June.

Nutmegs.—Nutmeg prices appreciated greatly at the beginning of July but fell rapidly owing to poor demand. Average prices per picul for July were:—110 per lb., $23.80; 80 per lb., $33.80 as compared with $20 and $26 per picul respectively in June.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd., and the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133⅓ lbs. 1 coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JUNE, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	12,296	13,273	11,316	67,483	8,727	52,009	Nil	Ni	Nil	26	11,743	6,678	78,114	41,869	13,679	13,512	...
Johore	...	2,315	3,995	3,408	20,882	3,652	23,350	Nil	3	Nil	12	781	6,522	4,415	40,605	2,301	3,769	...
Kedah	...	416	2,148	2,024	12,020	1,079	6,328	Nil	Nil	Nil	Nil	578	2,479	3,688	15,099	395	2,215	...
Perlis	...	9	5	5	44	13	66	Nil	Nil	Nil	Nil	Nil	17	Nil	116	9	6	...
Kelantan ...	...	179	78	163	1,040	519	2,513	Nil	Nil	12	Nil	83	496	430	3,091	208	152	...
Trengganu ...	..	55	50	113	580	57	290	Nil	Nil	Nil	Nil	Nil	170	Nil	870	55	50	...
Total Malay States	...	15,270	19,549	17,029	102,049	14,047	84,556	Nil	3	12	38	13,185	16,362	86,647	101,650	16,647	19,704	...
STRAITS SETTLEMENTS																		
Malacca ...	...	2,878	1,375	1,246	7,019	(2) 2,626	(2) 13,163	Nil	16,416	Nil	101897	3,371	Nil	27,918	Nil	3,052	1,389	...
Province Wellesley	...	151	532	463	2,581			Nil		Nil						133	595	...
Dindings ...	...	94	92	99	555			Nil		Nil		5,012				116	109	...
Penang	1,025	4,476	9	7	44			610		4,313				36,329		5,139	6	1,475
Singapore ...	3,600	32,470	344	170	1,088			9,265		48,919		17,779		108,206		33,626	298	4,440
Total Straits Settlements	4,625	40,069	2,352	1,985	11,287	2,626	13,163	9,875	16,416	53,232	101,897	26,162	Nil	172,453	Nil	42,066	2,397	5,915
TOTAL MALAYA	4,625	55,339	21,901	19,014	113,336	16,673	97,719	9,875	16,419	53,244	101,897	39,347	16,362	259,100	101,650	58,713	22,101	5,915

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	11,171	31,552	4,656	3,114	963	51,456
WET RUBBER	2,508	2,074	483	187	1,338	6,590
TOTAL ...	13,679	33,626	5,139	3,301	2,301	58,046

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	26,363	168622
Penang ...	3,608	59,620
Port Swettenham.	4,223	27,913
Malacca ...	153	2,945
MALAYA ...	39,347	259100

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	30,152	206797
MALAYA ...	30,152	206797

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] estimated—[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, the figure represents purchases by dealers from local estates of less than 100 acres.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics S.S. and F.M.S., at Singapore on 22nd July, 1931.

GENERAL RICE SUMMARY.*

June, 1931.

Malaya.—The net imports of rice into Malaya for June amounted to 40,774 tons. Of total imports 47 per cent. was from Siam, 42 per cent. from Burma, 5 per cent. from French Indo-China and 1 per cent. from other countries.

The total imports of rice into Malaya for the first half year 1931 were 347,000 tons, the net imports (consumption of foreign rice) being 262,000 tons, or 32,000 tons less than for the corresponding period of 1930.

Stocks of padi and rice held by wholesale dealers and millers in the Federated Malay States and Straits Settlements at the end of May were :—padi 16,736 tons; rice 26,770 tons. These stocks, converting padi at 62 per cent. and adding estimated stocks in Johore and on estates amount to 50,636 tons of rice.

Harvesting has been completed throughout Malacca, the greater part of Perak, including the Krian irrigation area, and Perlis. Cultivation is in progress in most other areas. The heavy rains experienced in June have assisted this work in many districts.

India.—Total foreign exports of milled rice during January to April 1931 were 802,000 tons, a decrease of 482,000 tons as compared with the corresponding period of 1930 and a decrease of 172,000 tons as compared with the average exports of the corresponding period for the past 6 years.

It is reported that the Burma export of rice and rice products from January 1 to June 6, 1931, was 1,878,746 tons as compared with 2,117,503 tons for the same period of the previous year, or a decrease of 11.3 per cent.

Japan.—An official communication states that the area under rice during the first crop of 1931 was 677,978 acres, being 18,358 acres more than the previous year, due to the abundance of water at the time of planting. The estimated production is 502,933 tons, being 14,506 tons or 2.97 per cent. more than the 1930 figure and 14.8 per cent. above the average for this crop during the past five years.

Siam.—The exports of rice from Bangkok, from December to May inclusive were 638,000 tons as compared with 644.000 tons for the corresponding period of the season 1929—31.

The production of rice for the year 1930—31 shews a marked increase over previous years. The area of land planted with padi in the seven main exporting circles was 4,623,736 acres, being 108,404 acres more than in the previous year. Moreover, the damaged area was considerably less than in the previous year.

*** The following is an abstract of the General Rice Summary for June, 1931, compiled from various sources by the Registrar-General of Statistics, S.S.**

Java, Madura and N.E.I.—At the end of May the area under "wet" padi was estimated to be 7,251,000 acres, being about 25,000 acres more than in 1930, while the area under "dry" padi was 1,165,000 acres, or 13,000 less than in 1930.

The Netherlands East Indies imported 288,000 tons of rice during January to May, or 61,000 tons less than for the same period of 1930.

French Indo-China.—For the first half year 1931 exports of rice were 526,450 tons as against 709,620 tons for the corresponding period of 1930.

Prices of padi remain firm and stocks in hand are barely able to cope with the business done. The temporary jump in the price of silver caused a similar increase in the price of padi.

The rice market was active in June, but at the same time the only market interested at present prices was France. Practically no business was done with any Far Eastern market. At the end of the month the tendency was very steady.

Ceylon.—Imports into Ceylon, January to May inclusive were 179,328 tons against 196,483 tons for the corresponding period of 1930.

Europe.—The quantities of rice shipped from the East were, according to the London Rice Brokers' Association Weekly Circular dated June 11, 1931 :—

To Europe during the period January 1 to June 11, 522,000 tons, an increase of 18.1 per cent.;

To the Levant, period January 1 to April 26, 16,000 tons;

To the West Indies and America, period January 1st to May 13, 85,000 tons.

METEOROLOGICAL SUMMARY, MALAYA. JUNE, 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of		Mean of A and B	Absolute Extremes				At 1 foot	At 4 feet	Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.		Highest Max.	Lowest Min.	Lowest Max.	Highest Min.					Amt.	Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	90.9	73.2	82.1	95	69	85	75	84.9	85.6	6.27	169.3	1.60	17	13	4	1	3	178.10	5.94	48
Bukit Jeram, Selangor ...	88.9	74.1	81.5	92	72	84	76	85.4	87.4	4.08	103.6	1.18	13	9			1	198.65	6.62	54
Sitiawan, Perak ...	90.1	73.7	81.9	94	70	84	76	85.3	85.7	9.87	250.7	2.55	12	9	3			204.40	6.81	
Kroh, Perak ...	86.9	70.9	78.9	91	67	79	73	82.3	83.2	10.60	269.2	2.34	18	16	2	5		165.70	5.52	
Temerloh, Pahang ...	90.2	73.8	82.0	94	72	83	75	86.0	87.1	6.07	154.2	1.63	17	13	5	11		173.90	5.80	47
Kuala Lipis, Pahang ...	89.0	72.9	80.9	92	71	84	75	84.3	85.0	3.70	94.0	0.77	12	11	10	17	1	148.10	4.94	40
Kuala Pahang, Pahang ...	87.3	75.1	81.2	91	72	83	79	85.4	86.0	5.97	151.7	1.96	13	10	4			213.50	7.12	58
Mount Faber, Singapore ...	88.3	76.9	82.6	93	73	79	81	82.6	83.9	10.17	258.3	2.27	14	11				193.20	6.44	53
Butterworth, Province Wellesley ...	88.1	75.2	81.7	91	73	84	79	85.9	86.5	12.13	308.1	3.32	17	14	2		1	191.70	6.39	
Bukit China, Malacca ...	85.6	74.4	80.0	88	70	81	77	82.9	84.3	15.20	386.1	5.34	15	14	3			203.00	6.77	55
Kluang, Johore ...	88.3	72.4	80.3	93	70	79	77	82.5	83.2	9.25	235.0	2.25	19	16	4	9		168.30	5.61	46
Bukit Lalang, Mersing, Johore	88.3	73.3	80.8	92	71	79	77	83.5	83.6	5.06	128.5	1.90	13	10				203.90	6.80	55
Alor Star, Kedah ...	88.4	75.1	81.7	93	72	81	78	86.6	87.0	18.91	480.3	6.50	21	19			1	189.85	6.33	51
Kota Bahru, Kelantan ...	90.3	74.4	82.3	93	73	86	77	85.5	86.0	4.13	104.9	0.88	15	12	1			186.70	6.22	50
Kuala Trengganu, Trengganu	90.2	74.2	82.2	95	72	85	77	85.3	86.5	2.94	74.7	0.74	10	7	1			214.30	7.14	58
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	73.3	60.6	66.9	77	58	67	63			4.75	120.7	1.23	17	15		2	1	148.10	4.94	40
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.9	57.7	65.8	78	53	68	62	71.8	71.0	4.89	124.2	0.90	17	15		2	1	144.50	4.82	39
Fraser's Hill, Pahang 4268 ft.	75.3	63.1	69.2	79	60	68	65	72.2	73.0	7.89	200.4	1.52	20	17	3	17	1	154.60	5.15	42

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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REVIEWS.

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STATISTICAL.

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The Director of Co-operation.
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THE

Malayan Agricultural Journal.

SEPTEMBER, 1931.

EDITORIAL.

The Malayan Pineapple Canning Industry.

In appointing a Conference to enquire into matters affecting the Malayan pineapple industry and to suggest methods of improvement with special reference to the English market, His Excellency The Governor created an opportunity for a thorough review of the present methods of cultivating the crop and canning the fruit and of comparing and placing on record the points of view held by the three branches of the industry in Malaya, *viz.* growers, packers and exporters. In addition, the Malayan Information Agency and the Empire Marketing Board were able to assist the Conference by information on the method of trading canned pineapples with particular reference to the United Kingdom.

The official members of the Conference consisted of the Director of Agriculture as Chairman with three other officers of his Department, H.M. Trade Commissioner for Malaya, the Commissioner of Lands, Straits Settlements and the Commissioner of Lands and Mines, Johore. Owing to duties in other directions the last-named officer was unable to attend the Conference meetings and therefore did not sign the Report.

Owing to the delicacy of the position, the official members agreed that it would be inexpedient to nominate representatives of the growers and canners interested to attend all sessions of the Conference and it was decided to invite a number of gentlemen connected with the industry to appear in turn before the official members of the Conference and to discuss with them the position. The Conference is grateful to the 13 gentlemen who accepted the invitation to meet the Conference to state their views. They consisted of 4 representatives of the Johore and Singapore small growers, 5 representatives of the canners and/or exporters, three Health Officers and the Registrar of Imports and Exports.

Four meetings of the Conference were held in Singapore. The Report and Proceedings of the Conference were submitted to the local Governments in April 1931 and the Report published at the end of August.

It is to be noted that the Commissioner of Lands and Mines, Johore, did not sign the Report as he was unable to attend the meetings. The Commissioner of Lands, S.S. proceeded on leave before the draft report reached its final form. The divergence of his views from those of the remainder of the members was

stated in a memorandum a resumé of which is appended to the Report together with the reply drawn up by the other members.

We attach very great importance to the Malayan pineapple industry and therefore any authoritative report on the subject is worthy of the widest publicity. It is for this reason that we have replaced articles which had already gone to press for this number of the *Malayan Agricultural Journal* by an abridged report of the Conference. This account is practically a full version of the Report, only paragraphs dealing with the constitution and method of work of the Conference and certain statistics having been omitted.

The fact that the Government considered it advisable to appoint a Conference on this subject proves that the value of the industry of pineapple packing is one of considerable importance to the country and it is surely not an unfair inference to suppose that His Excellency was doubtful as to whether the industry was at present established on a satisfactory foundation.

The Report early indicates that the Malayan pineapple industry has no great amount of stability and proceeds to point to its weaknesses, to shew how they have arisen and to make recommendations towards the establishment of the industry on a firm basis.

It would be out of place for the present writer, who was a member of the Conference, to review critically the report for which he takes part responsibility. The reader is therefore invited to read the report and form his own conclusions from the information given and from his own knowledge of the conditions obtaining in this industry.

The following summary is appended to the report and forms a useful index to its recommendations :—

" The principal recommendations of the Conference are as follows :—

(1) " That owing to the natural suitability of Malaya for the cultivation of pineapples the industry represents an asset of considerable value, and as such should be a matter of concern to Government. In other parts of the world efforts are being made to develop and extend the pineapple industry, while the conditions at present occuring in Hawaii, owing to the incidence of pineapple wilt disease, afford an opportunity for the extension and stabilisation of pineapple cultivation on a large scale in Malaya, which should not be neglected.

(2) " That, as it has been conducted in the past, the industry lacked stability owing to the fact that it has been largely, if not entirely, carried on as a catch crop between young rubber and treated as a means to an end rather than as an end in itself. This should not, however, be allowed to obscure the possibilities which the industry offers for stabilisation and expansion.

(3) " That the present depressed position of the industry is largely due to the lack of financial resources among growers and the methods of marketing which have sprung up in consequence, which have led to

destructive competition. Efforts to improve the industry must therefore tend to impart greater stability and confidence if they are to be successful.

(4) "That the demand for Malayan canned pineapples in the United Kingdom is steadily increasing, largely as the result of the work of the Malayan Information Agency in connection with shows and exhibitions; that the present state of the market bears no relationship to stocks and to demand. That a continuation of this policy must tend to increase the demand and is advocated.

(5) "That the most important and fruitful line of expansion probably lies in the development of large scale plantations with sufficient financial resources behind them, and that such enterprises should be encouraged.

(6) "That further investigations concerning the agricultural requirements of the crop are badly needed and should be carried out.

(7) "That to improve the position of the industry any steps likely to lessen the speculative element and to inspire confidence are likely to prove advantageous.

(8) "That one of the present chief sources of weakness lies in the fact that no means exist at present for enabling consignments to be traced back to individual factories; in consequence legislation is recommended requiring that each case and tin before it leaves the factory should be stamped with an identifying mark which while it should be registered by Government and should be known to shippers and wholesale buyers, would be of such a nature as to disclose nothing to the retailer and consumer.

(9) "That in view of the present irregularity in the pack and the lack of confidence which this entails, the introduction of systematic government grading and inspection of produce before it leaves the factory is desirable, the cost of which would be met by a small export cess on canned pineapple. It is recommended that such a grading service should be optional during the initial stages.

(10) "In order that the advantages which Malaya offers for the cultivation of Malayan pineapples may become more easily appreciated, it is recommended that the Malayan Governments should examine the possibilities of fostering and assisting development by alienating land suitable for pineapple cultivation on favourable terms provided that adequate guarantees are forthcoming both as to cultivation and manufacture.

(11) "It is also considered that the possibility should be explored by the Government of rendering financial assistance to undertakings that are desirous of establishing pineapple cultivation and canning on a sound basis following the example of certain other countries in this direction."

Amongst the main recommendations of the Conference is that of Government inspection and grading. This is no new idea. It is an established practice in almost all fruit canning countries and has been extended to all the important food products—meat, fruit and vegetable. It has as its main object the creation of confidence in the particular product amongst consumers and should therefore result in the establishment of a regular demand at stable prices.

Hitherto, the success of Malayan canned pineapple products has been based on their cheapness in competition with similar products from other sources and other canned fruits. This cheapness has been made possible chiefly by the fact that pineapple cultivation in Malaya has been treated as a catch crop with young rubber. This state of affairs cannot continue indefinitely and with the present slowing up of rubber planting, we are already in sight of a curtailment of supplies of fruit. The sacrifice of this Malayan industry, the exports of which are valued at approximately £1,000,000 per annum must be prevented and this can only be achieved by a re-organisation of the industry.

The Malayan Information Agency and the Empire Marketing Board have done much in the past two or three years to popularise Malayan pineapples in the United Kingdom and there are possibilities of developments on the Continent of Europe, given a continuation of supplies and a stabilisation of quality.

An article written by the Empire Marketing Board on the Canned Pineapple Trade was published in the July, 1931, number of *The Malayan Agricultural Journal*. It is there shown that 84.4 per cent. of the imports of pineapple into the United Kingdom come from Malaya, while 28.2 per cent. of the total import of all fruits canned in syrup are pineapples.

This is satisfactory reading and if we could be sure of holding the position we have gained there would perhaps be but a weak case for the re-organisation of the industry in Malaya. But competition is becoming stronger, not only from the Colonies and America, but in particular from the recently established and rapidly expanding canning industry in the United Kingdom.

A good impression of the canning industry in the United Kingdom may be gathered from the special Canning Supplement published with the *Manchester Guardian Commercial* on May 14, 1931. It is there stated that the 1930 pack of fruits exceeded 30,000,000 cans which was nearly double that of 1929 while reasons are given for supposing that production has by no means reached its maximum. The industry really began to get into its stride only five years ago, and as little as two years ago there were only five firms engaged in it; to-day nearly forty well established firms are in the field, while the capital invested is stated to exceed £3,000,000.

Admittedly, the English canners do not deal with pineapples, but the wider choice of canned fruits offered to the public must necessarily have its repercussion on the Malayan trade in canned pineapples.

In addition to competition from our old trade rivals, and from the newly established industry in the United Kingdom, competition in canned pineapples

may also be expected from the Far East, for the Formosa industry in canned pineapples shows every sign of rapid development.

It therefore behoves Malaya to design a policy that shall ensure the continued growth and prosperity of the Malayan canned pineapple trade. An Editorial in the *Manchester Commercial* referred to above states—

> "..................Canning is a highly specialised business, and while money may be found, and up-to-date plant bought, that alone is not going to make for success; qualified men are indispensable.................. The Canners' responsibility to the public is so great that very little careless work might well jeopardise the reputation they have built up. Briefly, then, it is to be hoped that development will extend on the safest possible lines—through existing canning firms who have the knowledge and experience essential in turning out products, reliable in every way."

These remarks may well apply to the Malayan canning industry. We may commence the re-organisation of our industry with the very great advantage of a market already established and with our factories that are now constantly being improved. The problems before us are therefore :—

(a) to ensure future supplies of fruit;

(b) to ensure the quality of the canned fruit;

(c) to organise the marketing to the best advantage of the industry as a whole.

Throughout the trade, from grower to the London market, is a chain of men with experience that has been built up during the past 25 years. It is to be hoped that they may throw the weight of their knowledge and experience into the pool for the establishment of the industry on the soundest economic basis.

THE PINEAPPLE CANNING INDUSTRY IN MALAYA*

General.

The Malayan pineapple canning industry took its rise somewhere about 1904. Up to the present it has been maintained practically exclusively as a means of handling pineapples grown as a catch crop between young rubber, and has been carried on almost entirely by Chinese. It will thus be seen that the origin of the pineapple industry is contemporaneous with that of the rubber industry and in its present form it may be described as a by-product of the rubber industry.

The industry began in Singapore and was until about 1921 practically entirely confined to that island, the produce being known as Singapore pineapples. The very considerable extensions of rubber planting which took place in South Johore about that time, however, brought about a corresponding increase in the planting of pineapple as a catch crop in that State; this was the outcome of the fact that much of the development in Johore was effected by Chinese planting interests in Singapore which naturally tended to make use of methods similar to those which had been already employed successfully in Singapore in a similar connection. Up to the present, the only other area in Malaya in which pineapple growing has become established is in Selangor; elsewhere in Malaya the crop is not at present grown for export.

It is obvious that under these conditions the industry has no great amount of stability, while the set back which the rubber industry has lately suffered owing to the slump seems in due course bound to have its repercussion on the pineapple industry; the situation is accentuated by the fact that the Malayan Governments have decided that until further notice no lands should be alienated for rubber planting. In existing circumstances it would seem that during the next few years the area under catch crop pineapples will in all probability decrease considerably, inasmuch as the planting of new areas under rubber is in the circumstances bound to decrease also. It is true that in Johore considerable areas still exist which have been alienated for rubber but not yet planted and that on these pineapple cultivation may be undertaken for some time to come, but on the whole, it seems probable that the general tendency will be towards the decrease in the area planted in pineapple as a catch crop, inasmuch as when the rubber matures the pineapple crop must be removed and unless the new restriction on fresh alienation of land for rubber cultivation is rescinded, there seems little possibility of continuing the existing system on the present scale for any lengthy period.

The prospects of the industry are still further adversely affected by the prices at present ruling for canned pineapples, which are lower than any recorded

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*The following is an abridged Report of the Pineapple Conference held in Singapore on December 18, 19 and 20, 1930 and March 9th, 1931.

since 1915. While the price for rubber continued to be high, and large new areas were being opened up for rubber planting, the cultivation of pineapples as a catch crop could be undertaken profitably inasmuch as the return, even at very low prices for pineapples, constituted a distinct saving in respect of weeding and cultivation charges which would in any event have to be faced, while not infrequently rubber plantations established in this way changed hands at very profitable figures once they came into tapping. Now, however, the only possibility for the indefinite continuation of the industry would appear to lie either in its development as a main crop or as a catch crop between some other form of permanent plantation. It is impossible to say in the present disturbed state of the world's markets what the prospects in this latter direction are: they may be appreciable, but in any event on purely a catch crop basis it seems unlikely that the industry can ever have any real permanent stability.

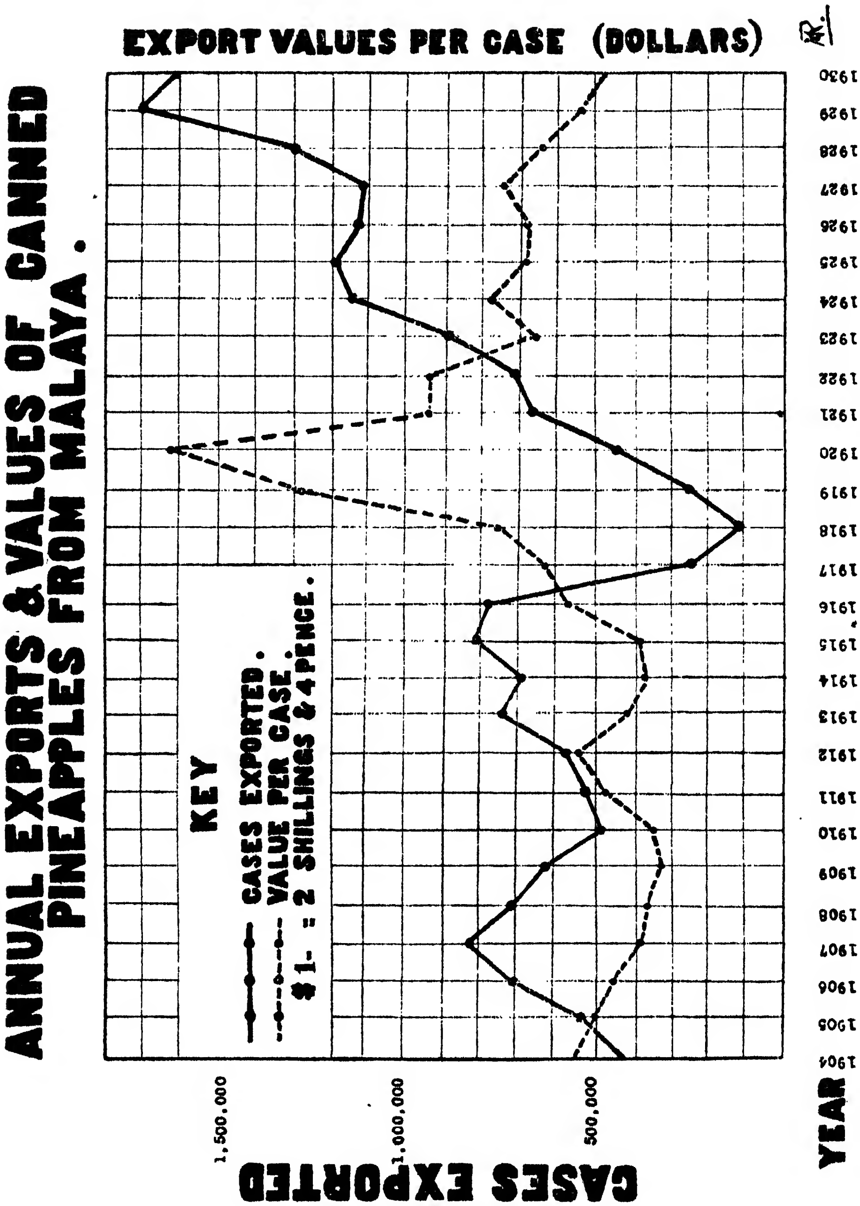
At present prices there would not seem to be great possibilities of establishing the industry on a permanently paying basis as a main crop: nevertheless the industry is a valuable one: the total exports of Malayan canned pineapples during the year 1929 amounted to 58,692 tons valued at $9,233,732, while those for 1930 were 57,959 tons valued at $7,859,026. A definite market and demand exists for the product in the United Kingdom and it is certain that whatever else may happen, that demand will continue if the price to the consumer is not materially increased. This demand will keep pace with the strongly increasing demand for canned fruit of all descriptions. It is obvious, especially at the present juncture, that an industry with an established and certain demand for its products in the United Kingdom is an asset of great potential value. In consequence, a critical examination of the position having for its object the ascertaining of the cause of the weaknesses of the industry together with possible remedies is of importance.

Quantity & Value of Exports of Malayan Pineapples.

The accompanying graph shews the quantity and values of exports of canned pineapples from Malaya from 1904 to 1930.

It will be seen that between the years 1904 and 1921 the annual export ranged between 100,000 and 850,000 cases, with corresponding wide fluctuations in price; in 1919 the price underwent a sudden rise, probably due to the post-war boom and shortage of supply which had occurred as the result of war conditions. Thereafter the production has steadily augmented, while prices have steadily declined. Compared with other years the average price for the year 1930 is lower than for any corresponding period since 1915, while during the month of September, 1930, the market price of $3.30 per case is almost the lowest ever record.

If these figures are taken at their face value it would appear that they present an example of the operation of the ordinary law of supply and demand, that if the natural course of events is allowed to operate the present low market value is bound to result in a shortage of supplies which will in due course bring in its


ANNUAL EXPORTS & VALUES OF CANNED PINEAPPLES FROM MALAYA.
EXPORT VALUES PER CASE (DOLLARS)
KEY
CASES EXPORTED.
VALUE PER CASE.
$1- = 2 SHILLINGS & 4 PENCE.
1,500,000
1,000,000
500,000
CASES EXPORTED
YEAR
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930

train a rise in price. To an extent this is undoubtedly true; on the other hand, there is also no doubt that there are a number of other factors operating which tend to make the position worse than it should be.

This is more clearly seen when it it stated that at the present time stocks of canned pineapples are lower than they have been for many years both in Singapore and London; that the demand is steadily increasing; that the reputation which the fruit enjoys in the English market has considerably improved of recent years; and that on evidence presented to us from a number of sources, there is definitely no over-production at present.

The Position of Malayan Canned Pineapples in the World's Market.

The world's production of canned pineapples at the present time is principally divided between two countries, *viz.* Hawaii and British Malaya: there is also a small export from South Africa and Australia, while in Formosa there is also a steadily increasing production, which at the present time is actually consumed in Japan and China.

The average annual exports from Hawaii would appear to be about 425,000,000 lbs. valued at about $40,000,000 gold. The Malayan trade comes second in importance. Hitherto, Hawaiian canned pines have hardly entered into competition with the Malayan product, as the aim of the Hawaiian producer has always been to produce an article of first class quality selling at a relatively high price. Malayan pineapples have, on the other hand, always ranked as a comparatively inexpensive article and have come to occupy the place of the cheapest canned fruit on the market.

During the past two years efforts have, however, been made to improve the quality of Malayan pineapples, and as a result the opinion has been expressed that the best brands of Malayan fruit can now compete on level terms with the product of Hawaii. This, however, only applies to a small fraction of the pack; in general the quality still falls decidedly below the highest standard. The principal defects at present encountered appear to be:—

(a) Irregularity of cutting and slicing;

(b) Lack of uniformity in the number of slices or cubes packed per unit tin;

(c) Lack of care in the preparation of the syrup.

The Malayan product at the present time has by far the largest share of the English market. It is estimated that 86 per cent. of the canned pineapples consumed in the United Kingdom are the produce of the British Empire, and of this Malaya's share represents 80 per cent. of the total. The latest available figures shew that for 1929 Malayan pineapples constituted 84 per cent. of the total exports from all countries into the United Kingdom.

The reputation and popularity of Malayan pineapples in Great Britain has been considerably enhanced during the past two years by the systematic advertising campaign which has been carried out by the Malayan Information Agency

acting in collaboration with the Empire Marketing Board. There is also reason to believe that a large untapped market may exist for the produce on the Continent of Europe.

Another important factor which influences the position at the present time is the prevalence of a disease amongst pineapple plantations in Hawaii, known as pineapple wilt. This disease is reported to have severely affected the output of many of the Hawaiian plantations, while so far no satisfactory remedy has been found for it, so much so that certain of the Hawaiian companies are reported to be opening up plantations in the Philippines, while one of the most important, namely Messrs Libby & Co. have recently acquired a large block of land in Kenya for the purpose of embarking on pineapple cultivation on a large scale in that Colony.

Soils and conditions suitable for Pineapple Cultivation.

Pineapples grow best on fairly open sandy soils as the plants require free drainage; for this reason also gently sloping lands are to be preferred. These conditions are met with on the majority of the inland areas, wherever topography lends itself to free natural drainage. In particular the quartzite soils, and the granite soils are known to produce the crop very satisfactorily. Considerable areas of this type of soil exist. Pineapples can also be grown on other soil types and also, in particular, are frequently grown in Malaya on peat soils, although under the latter conditions the fruit is not of such good quality, nor does it ripen so readily.

Equatorial conditions such as are encountered in Malaya are particularly favourable for the crop, inasmuch as thereunder the fruit is harvested in two crops of about 3 months duration each, *viz.* in May, June and July, and October, November and December respectively, of which the May—July crop is somewhat heavier and of slightly longer duration than the October—December crop, instead of in one big crop and one small crop as occurs in Latitudes further north and south of the equator. Conditions such as these make possible the employment of smaller factory units, and make for economy in labour inasmuch as they enable a smaller labour force to be employed for a longer period and tend to minimise the necessity for having a large labour force to deal with a harvest covering a short period of time.

The marked suitability of Malaya for Pineapple Cultivation.

From what has been said it is clear that Malaya is peculiarly favourably situated for the cultivation of pineapples; added to its considerable natural advantages it possesses an established market for the produce, combined with a steadily increasing demand. Against this must be set the fact that at present the industry is in considerable difficulties and is certainly not remunerative to

growers. Until recently the industry has always been regarded locally as a mere incident in the development of the rubber industry, and as such of little real or permanent importance. No attempts have been made to improve cultural methods or to assist the growers. The inception and development of the industry is entirely the outcome of the initiative and enterprise of members of the Chinese community and to them credit is exclusively due for having endowed Malaya with an industry of considerable importance, the produce of which is valued at upwards of £1,000,000 annually, coming fifth in this respect in the exports of Malaya. The fact should not, however, be overlooked that other countries are becoming alive to the opportunities presented by this form of cultivation. Mention has already been made of developments likely to take place in Kenya, and of the growing trade in Formosa, in Mauritius also the Government has recently heavily subsidised an experimental factory with the object of endeavouring to develop a pineapple industry.

Areas under cultivation in Pineapples in Malaya.

The Malayan pineapple industry is confined to three administrative areas, namely, Singapore, Johore and Selangor. The approximate total areas under the crop are estimated as follows:—Johore 40,000 acres, Singapore 8,000 acres, Selangor 4,000 acres. As stated, practically the entire area is interplanted as a catch crop between young rubber and although various proposals have been put forward for planting pineapple as a main crop, none of these so far have materialised. In Singapore land has been given out for cultivation in small areas of 2 to 5 acres each but in practice they have tended to become combined into blocks of approximately 200 acres each under the control of one individual and worked by the lessor by contract and day labour. In Johore areas have been given out in large blocks and are subdivided by the owners and worked either on contract or on the "squatter" basis. There is, however, an area of approximately 10,000 acres in Senai District, Johore, which is entirely worked by small-holders. In Selangor there is only one large area worked by a Chinese planter; the remaining areas under cultivation in that State consist of small holdings.

Methods and Cost of cultivating Pineapples in Malaya.

Figures for the cost of cultivating pineapples are to some extent conjectural. From information gathered by the Department of Agriculture the following is an estimate of the probable cost per acre of cultivating the crop:—Rent, say $3/-, Clearing the land $30—$40, Purchase of suckers $3—$5, Planting suckers $3, Weeding and cultivation 1st year about $24. The subsequent upkeep would amount to about $2—$5 per mensem.

As the crop is at present grown entirely as a catch crop on virgin lands or reclaimed secondary jungle, the question of manuring does not come in to the

calculation, but if the crop is to be grown as a main crop, manuring must in due course become essential. No information is at present available concerning the manurial requirements of the crop in Malaya.

The variety of pine principally cultivated is that locally known as the Queen pine. A number of other varieties are also cultivated on a small scale, but are not locally considered as suitable for canning. The Queen pines give a fruit which when ripe possesses flesh of a golden yellow colour and excellent flavour. The smooth Cayenne pine which is the standard variety grown in Hawaii is not, so far as is known, grown at present. Planting is usually performed at a distance of 5 feet by 2½ feet, with a six foot path at about every 100 feet. This spacing gives from 3,000 to 3,400 plants per acre. No information is available regarding optimum planting distances. Cultivation consists in weeding between the rows and in mounding up the pines.

The Department of Agriculture is now undertaking the organisation of a Pineapple Experiment Station in Singapore which will be devoted to obtaining information on all these points; an experimental programme has been laid down which is being duplicated at the Experimental Plantation, Serdang. We think that information on these points is of vital importance if the industry is to be stabilised on the basis of cultivation as a main crop and we would here emphasise that the cultivation of pineapples as a sole crop constitutes the most promising development for the permanent existence of the industry. Though the industry has now been carried on successfully for about 26 years with pineapples as a catch crop, it seems improbable, though not impossible, that opportunities for cultivation on these lines will continue to occur.

The first crop is generally harvested 18 months after planting, from 1,200 to 1,500 fruits per acre being obtained. Thereafter, for a further 3½ years to 4 years, two main crops are reaped annually, namely in May, June and July, and in October, November and December, although small amounts of fruits are coming in all the year round. After the crop is in full bearing, the first four crops give 4,000 to 5,000 fairly large fruits per acre per annum followed by three or more crops smaller in number and poorer in quality. One witness stated that cropping could be maintained up to ten years, but it it considered doubtful whether this is an economic procedure.

Disposal of the Fruit by Growers.

The fruit is either sold by the growers to the canneries at the factory doors or on the road-side, and is also purchased by passing lorries at road-side for re-sale to the factories. Prices vary according to the market value for canned produce and also according to the supply and the quality of the fruit. At present the average price in Johore ranges from 70 to 85 cents per hundred fruit delivered at the factory, although for first class fruit, prices have ranged as high as $1.50.

When the market is low it is apparently the practice to endeavour to pass on to the grower the whole of any fall in price which takes place, though it is not clear that the grower obtains the full advantage of any rise that may occur.

In Singapore prices rule slightly higher than in Johore. This is apparently due to the fact than an export duty on both fresh and canned fruit is levied by the Johore Government *viz.* 12½ cents per 100 on fresh and 4 cents per case on canned fruit and also to the cost of transporting fruit from Johore to Singapore. A certain proportion of the Johore crop goes to the Singapore canneries, which are unable to operate full time on the produce of Singapore Island alone.

At existing prices *viz.* 80 cents per 100, the return apparently does little more than pay for the cost of collection and transport and yields practically no profit. Various witnesses informed us that it was considered that a fair price for pines would be about $2 per hundred and that at this figure a reasonable margin of profit to the grower would be assured. To enable such price to be paid we were informed that a minimum of $4.50 per case f.o.b. Singapore would be required. It is to be observed that this price is considerably below the values which have ruled for a number of years past with the exception of 1930.

No system of advances to assist small growers exists; frequently growers are not paid for their produce on delivery and have to wait for payment until the factory has realised an advance on a delivery for shipment. A small growers' Co-operative society, if and when possible, might provide a remedy. At present it does not appear to be feasible.

Conditions in Relation to Manufacture.

There are at present 18 canning factories in Malaya. Of these 5 are situated in Singapore, 12 in Johore and 1 in Selangor. They are for the most part primitive and consist of temporary buildings constructed of wood and galvanised iron. It is stated that some of these were not built as pineapple factories but as godowns. This form of construction was adopted owing to the conditions under which the industry existed; the cultivation being in the shape of a catch crop between young rubber was fugitive, and was bound to be displaced as soon as the rubber approached maturity. Consequently, the type of factory evolved was such as required comparatively little capital for its erection and at the same time could readily be dismantled and re-erected elsewhere as soon as the area which it was originally intended to serve had become converted into mature rubber plantations.

For the same reason there has been little or no expenditure on expensive or heavy machinery; the whole of the operations of peeling, coring and slicing the fruit as well as the syruping and sterilising of the cans being performed by hand. In Hawaii all of these operations are performed by highly ingenious machinery, but none of these machines have so far been imported into Malaya. The only machinery which forms part of the equipment of the ordinary Malayan pineapple factory is that required for the making of cans. All factories at

present working in Johore have now introduced tile-topped tables, but in some of these factories the water supply is still defective. In particular one factory has erected a modern building, installed a satisfactory water supply and more modern plant for can making. In Singapore all factories are situated within the Municipal limits and as such are subject to Municipal regulations and in consequence have the advantage of a pure water supply from the Municipal areas. All factories in Singapore employ white tiled trimming tables.

Lately, the Health Authorities in Johore have become active in this connection and have insisted on the maintenance of a better standard in relation to pineapple factories than formerly existed. Their activities have been regulated by the new Food and Drugs Enactment of Johore. It is to be remarked that the improvement in conditions thereby effected is an asset and that the attainment of a satisfactory standard of hygiene in these factories is of considerable importance. The Health Officer at Johore, Dr. Gross, who gave evidence before the conference, stated that he proposes to undertake a series of tests of the bacteriological purity of the products from different factories. It may be remarked that the Canadian Government has recently taken an interest in this question and the Canadian Trade Commissioner visited all the pineapple factories in Johore and Singapore for the purpose of preparing a list of products which would be admitted to Canada by reason of the fact that the factories in which they were produced had obtained a satisfactory standard of hygienic production.

Of the 18 factories one owner controls four. It is stated that this represents about 40 per cent. of the total output. A London firm now controls the output of two of the largest factories in Johore; this represents a further 30 per cent. so that 70 per cent. of the total output may now be said to rest in the hands of two producers. At the time of writing, of the remaining 12 factories, 5 are not operating owing to the fact that the proprietors have become financially embarrassed as a result of the general slump conditions at present prevailing which have affected their financial interests in other directions.

Forms of Packing Adopted.

The fruit is generally packed in tins each containing 1½ lbs. of fruit. The 1½ lbs. tins are packed in standard cases containing 48 tins. The fruit is packed in slices or cubes or whole pines; three grades are recognised *viz.* "Golden Yellow", "Good Average Quality", and lower grades. The "Golden Yellow" and "Good Average Quality" (G.A.Q.) grades are shipped to England and the lower grade to China. The percentage of "Golden Yellow" quality to "Good Average Quality" has been variously stated to range from 10 to 40 per cent. of the pack of individual factories, it is estimated to contribute 10—15 per cent. of the total output of Malaya. It is considered that with more intelligent cultivation and greater attention to the selection of fruit for canning, the percentage could be raised to 60 per cent. of the entire crop. A small amount of produce is shipped in the shape of pulp; at the present

time the market for this article is better than for either cubes or slices. Up to the present it has not been possible to extend its production greatly, on account of the fact that a larger size of tin containers is required which cannot be conveniently made by the existing can making machinery, while sterilisation of the product presents special difficulties with the existing sterilising plants. We understand that one firm is considering the introduction of special machinery for producing grated pineapple. The pines are packed in syrup of 11 per cent. strength, the cane sugar for making which is imported from Java.

Until recently complaints were very numerous concerning the quality of the packing, especially in relation to the grading of the fruit, it being quite usual to find that fruit shipped as "Golden Yellow" contained an appreciable quantity of slices or cubes of a lower grade. The differentiation is practically entirely on colour: the "Golden Yellow" quality consists of fully ripe fruit, "G.A.Q." and lower grades being obtained from less ripe fruit.

By-Products of the Industry.

The present methods of pineapple canning necessitate the rejection of about one-third of the fruit received in the factory, in the form of peelings, cores and bad fruit. The disposal of this waste has frequently been a source of considerable embarrassment to canners who have had the alternative of accumulating a considerable heap of this waste in close proximity to the factory or of incurring expense in its disposal at a distance from the factory.

The utilisation of this waste has been a subject of investigation by the Department of Agriculture, S.S. and F.M.S., and by the Hawaiian canners. It has been shewn* that for economic disposal of the waste matter, removal of the juice by expression is essential. The fermentation and distillation of the fresh juice for the production of potable alcoholic liquor similar to brandy or "samsu" is a simple process.

More recently, Hawaiian canners have commercialised the preparation of "Pineapple Bran" from the solid portion of the waste, and the export of pineapple juice obtained from the fresh peelings and cores. The former is employed for cattle feeding, while the latter finds a ready market in America and a developing market in the United Kingdom. The general adoption of similar methods of disposing of the pineapple waste from the Malayan factories is obviously desirable both on hygienic and economic grounds.

Economic and Financial Position of the Canneries.

The industry is characterised by the fact that it has always suffered from insufficient capitalisation. The small expense that has hitherto been involved

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* By—Products of the Pineapple Canning Industry by V. R. Greenstreet and Gunn Lay Teik. *Malayan Agricultural Journal,* Vol. XVI, No. 1, 1928.

in starting a factory, the transient nature of the cultivation, and the fact that the industry has in the past been largely regarded as a means to the end of inauguration of rubber plantations which were intended to be sold as soon as they reached maturity, has tended to attract thereto people of little or no financial stability but with a strongly developed speculative bent; as a result the whole industry is under-financed and is distinctly in the nature of a gamble. The present method of financing can only be described as hand to mouth; packers frequently depend on obtaining advances from merchants on deliveries of packed pinapples as they are effected to enable them to meet their obligations to growers for deliveries of fruit and to pay for the operation of the factory. No system of financing canneries by shippers or by merchants at Home is generally practised, although certain firms give credit to factories fór purchases of tin plate and other supplies, and also handle the produce of the factories, the two transactions to an extent mutually offsetting one another although they are treated as being separate and independent.

The only exception to this consists in the two factories in Johore which are being operated by an English firm. It seems possible that this may prove the first step towards the greater stabilisation of the industry, but it is as yet too early to pronounce an opinion on this point.

Marketing Methods current in relation to the Industry.

The speculative character of the industry is reflected and continued in the marketing methods employed. As stated above, the produce is delivered by the factories to various firms of merchants in Singapore who in turn dispose of the product to distributors.

Practically all the exporters are branch offices of London general merchant houses and the majority of these firms receive orders from England only through their own offices there. The Singapore Branch of one firm is an exception as it ships to its Export Department in London, which in turn sells to its own Canned Provisions Department. Another exception is the London firm which has assumed control of two Johore factories and which market their own products in the United Kingdom and Canada and sells to export firms in Singapore.

Fully reliable information as to the London position is not obtainable in Singapore, but many London firms sell most if not all of their imports to brokers, and it it probable that the majority of the trade passes through their hands. One firm has an organisation of travellers and sells part of its stock direct to wholesale or retail grocers, but a part is also sold through brokers. The brokers sell to, or rather buy on behalf of, wholesale and retail grocers.

The major part of the crop is disposed of in England, but of recent years there has been also a steadily increasing export to Canada and New Zealand while there is also a certain amount of trade with China.

For the most part the tins as they leave the factory have no distinguishing mark. A certain canner informed us that some time ago he had installed an

conditions will become more precarious than ever and confidence will be further shaken.

One might be tempted to urge that the direct remedies for the existing situation should follow those which have been successfully adopted in not dissimilar conditions in other places *viz.* the organisation of both growers and canners on a co-operative basis for buying and selling, the elimination of middlemen and direct sales to one or two selected distributing agents in the United Kingdom combined with some form of inspection and grading of produce which will afford the necessary guarantee of quality. These are the methods which are understood to have been employed with outstanding success, for example in the Californian fruit market where formerly production was in a condition somewhat resembling that prevailing in Malaya and where during the past 20 years, as the result of systematised work done on co-operative lines, the position of growers and packers has been very greatly strengthened and the industry placed on a firm basis.

Unfortunately, the adoption of these methods does not appear to be feasible at present among the bulk of the producers in Malaya. Many of the individuals concerned have numerous other interests the interlocking of which precludes combination, while the view is also held that the personnel of the industry, owing to its racial admixture, is unsuited to combination. We cannot help feeling that the chief hope for the future of the industry in all probability lies in the development of large scale undertakings with modernised factories which will grow a proportion of their pines and will also purchase produce from small growers on a fair basis.

It seems possible that the taking over of two of the best factories in Johore by an English firm may perhaps be the prelude to developments in this direction, but it is as yet too early to express an opinion on this point. At the present moment, many of the canneries are not satisfactory economic units, and they are so weak financially that they are very largely dependent upon exporters; without the financial support of the latter the industry would collapse as it is unable to obtain funds from any other source. Moreover, it is doubtful whether any individual factory is strong enough to keep the important retail distributors in the United Kingdom of the chain store type supplied with stocks of fruit which can be relied on for regularity in delivery and uniformity of quality. Consequently, the United Kingdom distributors find that the only way they can handle Malayan pineapples is to depend on Singapore shippers who are provided with their supplies by various factories. If it were possible for the canners to form a selling combine on the lines established in Hawaii, which fixes a price each season according to the demand and of which each member is free to ship under his own factory label, it might provide a solution of the case, but unfortunately there is little doubt that under present conditions such a scheme has small prospects of success.

Two of the gentlemen who gave evidence before us orally, strongly held the view that in order to improve the market for the produce it was necessary that

legislation should be enacted requiring that all pineapple products exported from Malaya should either be labelled with the name of the factory which produced it, or alternatively, that the lid of the tin should be embossed therewith.

It was pointed out by them that Malayan Pineapples are being sold in England under a large number of labels practically none of which bear any reference to the factories in which they are produced, and that this militates against the produce of any particular factory becoming known for its quality and is a bar to attempts to improve the produce by individual concerns.

One witness stated that he had for some time past been attempting to introduce his own mark on to the English market, but so far had obtained practically no success, the only place where his produce marked in this way had obtained a market was in China. He believed that if compulsory labelling or stamping was required it would put an end to the existing state of affairs whereby Malayan Pineapples were sold as a trade article in bulk, would substitute for it a condition whereby the produce of the individual factories would be sold on their own marks, and so would put an end to the existing speculative element.

At first sight the proposal seems attractive, but there are a number of points which militate against it. The first is that, as previously pointed out, it is doubtful whether any one factory could guarantee supplies of pineapples of sufficient quality and quantity to meet the demands of the largest retailing firms in England. The second and even more important, is that such a course will necessarily involve the elimination of a large number of brands which have already become known on the English market and their replacement by a smaller number of quite unknown brands. Such a process may be expected to be resisted vigorously by wholesale dealers in England who, it may be pointed out, have been responsible for building up the trade and by shippers in Malaya who are the only people at present who finance it. Between them they have popularised their own marks and at present hold the bulk of the trade in their own hands. The proposal, in fact, involves breaking down a trade that has become established along certain lines and replacing it on a different basis in the face of considerable opposition from financially powerful business organisations with established connections which, it should be observed, embrace not merely pineapples but a large range of other description of canned goods and other food products.

In the present disorganised state of the local industry there is no hope that it could surmount successfully difficulties of this description. The inability of the industry to form successfully a selling combine on the very simple lines previously attempted is, in our view, a clear index of its inability to face the much more difficult situation which legislation of the type proposed would create. It is also certain that any formal proposal for such legislation would be vigorously resisted by the Malayan exporters and by the English importers and wholesalers. Finally it may be pointed out, actual instances have occurred in the past where certain canners have acquired some reputation in the London market and have subsequently taken advantage of their brands being established in this way to ship grades far below market quality. In the circumstances it seems to us

by no means improbable that if the Government acceded to this suggestion and enacted legislation on the lines desired, the next thing would be an urgent request for its repeal emanating from the very sources which had proposed it.

We do not wish it to be inferred that the building up of a trade based on canners' marks and labels on the lines of the Hawaiian system is an undesirable end in itself, but the weakness of the industry itself, in our view, renders such method incapable of achievement at present. If the industry could attain a satisfactory standard of organisation with adequate financial backing and with properly controlled sales-distributing agencies in England, there seems to be no reason why, in due course, a trade on these lines should not evolve itself, but before this can happen greater stability must be sought by other less drastic methods.

A further point which affects the situation is that practically all the factories are either owned by Chinese or operated under Chinese names. Rightly or wrongly, at the present time there is a decided popular prejudice against Chinese food in the United Kingdom; it may be misplaced, but it is a factor which must be allowed for; further, the Malayan pineapple industry has hitherto been systematically advertised as Empire produce in connection with the propaganda of the Empire Marketing Board; it might be very difficult to reconcile, in the eyes of the British consumer, the advertisement of goods bearing a characteristic Chinese name with their continued inclusion in a scheme for pushing sales of Empire produce. For all these reasons we consider that legislation on the lines advocated by the two witnesses is inexpendient.

There is, however, another aspect of the case which, in our opinion, merits more favourable consideration. At the present time most of the produce comes forward in packages which bear no mark enabling them to be traced to their origin after they have left Malaya. This seems to be a distinct source of weakness inasmuch as the fact that tins cannot be traced after they have left the country is a direct incentive to careless work in grading and packing. We therefore consider that legislation is desirable requiring that each case and tin before it leaves the factory should be stamped or embossed with an identifying mark which would be registered by Government and would be known to shippers and wholesale buyers, but would be of such a nature as to disclose nothing to the retailer and the consumer.

This would in part meet the wishes of the producers as expressed above; it would be free from the objection which we have previously set out. and provided no opposition is offered to it by wholesalers in England, seems to us to be a reasonable and desirable provision.

We have already alluded to the dangers which exist in relation to the lack of standardisation and the probability of a fall of quality following on a rise in price. We think that a case may exist here in which Government assistance might be forthcoming by the introduction of systematic Government grading and inspection of produce before it leaves the factory and the enactment of legislation requiring that such grading should be done. Government produce

inspection schemes have been successfully introduced in West, East and South Africa in the case of various industries and have brought considerable benefit in their train. There appears to be good reason to believe that if the establishment of some form of Government grading could be effected a marked step towards the stabilisation of the pineapple industry would be achieved. There does not appear to be any insuperable obstacle in the way of the establishment of such a system of grading and it would certainly have, according to the evidence that has been presented to us, a very appreciable stabilising effect on the market. Those representatives of the canners and exporters whom we have consulted stated that such a scheme would be welcome, while there does not appear to be any ground for supposing that it would be opposed by buying interests at Home; on the latter point the Chairman has recently caused enquiries to be made through the Malayan Information Agency in England, and information has been received that such a proposal would be strongly supported by English firms.

It is estimated that such a scheme could be financed by a small export cess on canned pineapples; to give an idea of the probable amount, we may point out that in Australia the cess charged for a similar service is 1d per case. We recommend that the question should be fully investigated with a view to working out a scheme for the imposition of such a cess and the organisation of a system of inspection, and that if and when a satisfactory scheme has been worked out the necessary legislation should be imposed to bring it into force. The necessary legislation could probably be combined with the recommendation in the preceeding paragraph to make an enactment, which would be enacted in each of the territories concerned.

It is considered that probably the most satisfactory method of inaugurating such a system would be to make it voluntary during the initial stages—say during the first twelve months. Such a course would have the advantages—

(a) That it would materially facilitate the organisation of the grading service since all who adhered to it voluntarily may be expected to assist the grader to the utmost of their power, and this would greatly ease the overcoming of the inevitable initial difficulties.

(b) It would afford a demonstration of the advantages following such a course and so would facilitate the adoption of the measure by all concerned when it is considered expedient to render it compulsory on all.

In relation to the organisation of growers on co-operative lines, the difficulties foreseen have been indicated. We think, however, in spite of these, some efforts might be made further to explore possibilities in this direction. We are informed that a Chinese Agricultural Inspector for Singapore has recently been appointed and we suggest that among the activities of this officer should be comprised an enquiry as to the possibility of bringing about some measure of co-operation amongst growers.

embossing plant in his factories for the purpose of stamping the name of his firm on the tin lids, but that he was unable to find a market for produce stamped in this way in the United Kingdom and at present the only market for it is in China. Another firm has recently adopted an embossed design for the tops of tins produced from the two factories controlled by them. It is understood that the firm adopted this course for their own protection, but that they met opposition to the course from their clients in the United Kingdom. We have recently been informed by the Malayan Information Agency, who at our request have instituted enquiry in London as to the reception in London that was likely to be given to a proposal for embossing tins with the name of the canner, that it was undesirable to stamp tins with the name of Chinese factories. We are also informed that one exporting firm has received instructions from their London office to accept no tins whatever that are embossed.

Malayan pineapples are thus largely a more or less standard trade article and the wholesale and retail buyers in the United Kingdom have no means of identifying the factories from which the produce which they handle emanates, the only link being the Singapore mercantile firms which handle the produce at this end.

The produce is sold under the label of the English wholesale distributor, which usually contains no reference to the factory where the products are made. Labels are affixed either before shipment in Singapore or after arrival in the country of distribution. The tendency has been of recent years for the proportion of tins labelled prior to shipment steadily to increase, and at present it is stated that 70—75 per cent. of the exports are labelled in Malaya. The reason underlying this would appear to be mainly that labelling can be carried out more cheaply in Malaya than in the country of destination. Formerly labels when affixed in Malaya were supplied entirely from abroad, but recently some have been printed in Singapore.

In some cases the name of the exporting firm is printed on the labels. For instance, one firm of exporters receives labels printed with the name of their London house or that of a wholesale grocer, while another firm receives them printed with the name of their London house or without a name. Probably each label without a name is reserved for some large grocer of the chain store type. It may be mentioned here to shew the complicated character which the industry has assumed that while at the present time there are only 13 factories operating in Malaya and 70 per cent. of the crop is handled by two canneries, Malayan pineapples are sold under at least 70 different trade labels.

The state of affairs has led to a vast amount of speculation, and Malayan pineapples have been not inaptly described as a speculative counter in the market. Speculative forward buying is largely practised, while the lack of financial resources on the part of many of the canners and the consequent inability to hold stocks has further favoured destructive competitive buying and selling. In this connection may be quoted the following remarks from a memorandum supplied by the Malayan Information Agency—

"The destructive competition in the English Market...........is undoubtedly a serious contributory factor making for low prices which arises from:

(1) Canneries offering through more than one source here thus creating competition in selling;

(2) English export houses in Singapore selling pines short through their London Offices;

In regard to (1) and (2) canners have the remedy in their own hands, as to (2) while the existence of this factor and of the important part it plays is known, it is not an easy matter to convince canners that it is not ultimately to their interests to encourage trade with English Singapore Exporting Houses who are known to speculate in Singapore pines. For example:— On May 1st canners price is, say 3/3 for 1½ cubes May—June shipment. On the same date an English Exporting House will be offering firm May—June shipment at 3/1½—he takes the business—the canners then drop to 3/1½, but provided there is no firmer tendency in the market and with the English exporting house still offering freely at 3/-, this goes on and the English exporting house chooses the right moment for buying in their requirements in Singapore. Assuming the market has dropped to 3/-, buyers here have had their requirements filled or have withdrawn in anticipation of still lower prices and the exporting house, being the only buyer in Singapore, appears to the canner as a very useful ally. It is difficult to persuade the canner that had it not been for the activities of the particular exporting house the price would never have dropped from 3/3d. When it is obvious that certain houses are selling short and London representatives suggest buying for joint account the canners suggest that their London representatives buy for their own account. When this is done the canners almost immediately drop their prices, involving the London representative at a loss. It appears obvious that if it is not good enough for canners to support their own market it is not good enough for the London representative to undertake it. There is reason to believe that certain firms have frequently sold short during the past nine months."

We desire to add that all local interests whom we have consulted agree that the above is a fair and accurate statement of the position. We also desire again to point out that the present low prices are not the result of over-production, inasmuch as stocks at the present time are lower than they have been for many years. We have been assured also that the London market would probably have no objection to paying somewhat higher prices, but in view of the fact that pineapples are offering at very low rates, wholesalers naturally see no point in paying prices higher than those which are asked. In consequence, the conclusion is arrived at that while the present position is no doubt in part to be attributed to the present world wide depressed trade conditions, the greater part of it is due to lack of financial resources and inability to combine on the part of the growers or canners.

Measures which have been taken to improve the demand for Malayan Pineapples.

It is convenient at this point to refer to the work done by the Malayan Information Agency and the Empire Marketing Board with a view to popularising Malayan Pineapples by means of systematic displays at various trade and other exhibitions. The work commenced during the year 1928 when the Empire Marketing Board suggested to the Malayan Government participation in the Colonial Fruit Show in that year with a view to advertising Malayan Pineapples. The suggestion was accepted by the Malayan Governments and a very successful display was made. Thereafter the Malayan Information Agency commenced a systematic campaign with the object both of popularising the fruit by means of displays at exhibitions and also of showing new uses to which the fruit might be put by means of cooking demonstrations. Up to the present displays have been made at several exhibitions and as a result the demand for Malayan Pineapples has been considerably stimulated, while the reputation of the product with the trade has been decidedly enhanced, this being clearly shown by the readiness with which all important firms are now joining in and assisting the work.

Recently, the attempt has also been commenced to extend the market for the fruit to the Continent of Europe and a considerable display with this object in view was staged at the Colonial and Flemish Art Exhibition at Antwerp. The question is now under consideration of organising displays at other Continental shows particularly the Leipzig and Lyons Fairs: on the Continent, Malayan canned pineapples are at present almost unknown and there does not seem to be much doubt that a large untapped market exists there. One result of this new move is to bring into evidence once more the unsatisfactory condition in relation to marketing; as the result of the Antwerp Exhibition a demand for pineapples was created in Holland, but it was found impossible to arrange for shipment direct from Singapore to Holland on account of existing trade channels; the only possibility being to purchase pines in London for re-sale in Holland.

It seems reasonable to suppose from the effects of the only systematic effort so far made to improve the market for pineapples that similar efforts in other directions would probably be equally effective. It may here be mentioned that during the visit of Mr. Ormsby Gore to Malaya in 1928, Mr. E. M. H. Lloyd, Secretary to the Empire Marketing Board who accompanied Mr. Ormsby Gore on his tour, held a conference with canners and exporters in Singapore with a view to ascertaining whether something could be done to improve the standing of the industry. The Conference met under the Chairmanship of Mr. F. W. South, then Acting Secretary for Agriculture, and suggested that pineapples should not be exported except in cans which have embossed on them the name of the maker. Otherwise the Conference was unproductive of results.

It should further be stated that in 1926 the various canners endeavoured to form an Association to regulate the selling of the produce. The Association

continued in existence till 1928 and then came to an end. The reason for the failure of the Association appears to have been that in the first instance the canners attempted to hold produce for too high prices, and that subsequently various members of the combine, under the pressure of economic conditions, went behind the arrangement and sold produce at prices below the minimum agreed on by the combine; as a result, the combine collapsed and we are informed that at present there are no prospects of being able to revive it.

Possible means of improving the conditions of the Industry.

From what has been said it appears that the main causes for the present condition of the pineapple industry are—

(1) instability owing to the fact that cultivation has always been carried on as a catch crop, and as such has no permanent basis;
(2) insufficient financial resources of both growers and canners;
(3) inability on the part of the growers and of the canners to control stocks and sales;
(4) lack of uniformity in packing and grading which has tended to give the produce a bad name;
(5) lack of organisation in marketing which has led to pineapples being sold through a number of different channels and hence to destructive competition;
(6) lack of incentive to maintain an adequate standard for produce and lack of means of tracing shipments back to the factories whence they originated;
(7) speculative forward selling combined on occasions with short deliveries;
(8) general lack of confidence in the industry.

The matter may perhaps be summed up by saying that the industry suffers from lack of funds, lack of organisation, and lack of confidence. Consequently, any step calculated to inspire greater confidence may be regarded as likely to bring about some improvement.

It seems not improbable that the existing conditions, comprising a very low price, an increasing demand, low stocks and a tendency for supplies to shorten may at some time in the near future bring about a very rapid firming up of the market. If and when this occurs it seems probable that the immediate results will be—

(a) a further impetus to speculative buying;
(b) a sharp move towards further planting;
(c) a deterioration of quality.

The last event will probably be brought about by growers endeavouring to dispose of large quantities of immature fruits in order to take immediate advantage of the rise in price, while packers, in the absence of any scheme of control of quality, will also try to take advantage of the rise by forcing on to the market increased quantities of badly graded fruits; the result of this will probably be that

We have already pointed out that conditions for the cultivation of pineapples are probably more favourable in Malaya than in most other places and that considerable tracts of potential pineapple land still exist. It seems reasonable, in view of what has been said, to suppose that an opening exists for the further extension of the industry and also for the development of a higher class trade in pineapples once a measure of rationalisation and confidence can be imparted to the industry. There is probably a considerable market for a better class of article than is at present produced in Malaya and if a reasonable standard of production is assured with a reasonable financial stability, consumption can further be extended.

It has been suggested that before attempts are made to develop pineapple growing as a main industry it is necessary to await the results of the experiments on the manuring and cultivation of pineapples in order to ascertain whether it would be an economical proposition to grow pines as a main crop, and that until this information is forthcoming it might be unwise to take active steps to attempt to develop an industry on a main crop basis.

We think that this view may be ultra cautious and conservative. There is no doubt that experimental work on these points is desirable; there is, however, also no doubt that natural conditions on suitable lands in Malaya are more favourable to pineapple growing than is the case in the majority of countries, that the experience obtained in other countries is available as a guide, and that in other places developments are beginning without any such preliminary investigations. We have already alluded to the initiative being taken in Mauritius and Kenya, and we would here also like to point out that a report very recently received from the Empire Marketing Board indicates that the Japanese Government is making very considerable efforts to foster the development of the pineapple industry in Formosa, and that a beginning has already been made with what appears to be a serious attempt under Government assistance and advice to capture a part of the English market. In connection with the industry, the Japanese Government has already established nurseries for the raising and distribution of plants, introduced a system of compulsory inspection and grading of produce, and given considerable money grants for the purpose of subsidising the creation of modern factories.

Malaya is better situated than Hawaii, Formosa, Mauritius or East Africa, from the point of view of both climate and labour supply to retain and to extend the pineapple industry, and we think it would be unfortunate if it failed to retain the trade which it has built up if this can be avoided by timely measures of assistance similar to those which are forthcoming to aid developments elsewhere.

We therefore think that Malayan Governments would be well advised to examine the possibilities of fostering and assisting developments by alienating land suitable for pineapple cultivation on favourable terms, e.g. comparable with those adopted for oil palms, provided that adequate guarantees are forthcoming both as to cultivation and also manufacture in order that the obvious advantages

which Malaya presents in this direction should not be overlooked in favour of other countries. This suggestion has been strongly endorsed by the Malayan Information Agency.

We suggest that the desirability of providing facilities for assisting companies or undertakings that are desirous of establishing pineapple cultivation and canning on a sound basis might be considered. Government assistance to agricultural undertakings in the Federated Malay States is by no means a new idea; in this connection we may draw attention to the work of the Planters Loans Board during the past 17 years; elsewhere the principle has been adopted on a considerable scale in relation to other industries, notably in relation to erection of sugar factories in South Africa and in the West Indies, while recently the Mauritius Government has subsidised an experimental pineapple factory in that Island. We do not wish it to be inferred that we desire to advocate advances except where fully adequate guarantees are forthcoming and there appears to be—on expert investigation—satisfactory prospects of success.

In conclusion, we desire to emphasise once more that a trade of very considerable value has been built up in Malaya in canned pineapples, that the circumstances in which this trade has become evolved have tended to cause it to be regarded as an ephemeral thing with no great stability; that this view is almost certainly wrong and that the present condition of affairs is merely the outcome of the thoroughly unsound conditions on which the industry has been evolved and is maintained. It seems to us clear that if under these admittedly unsatisfactory conditions an industry of considerable value can become evolved, given rationalisation and a sound financial basis, it is capable of becoming an asset of great permanent value to Malaya at a time when additional resources are most urgently required.

Reviews.

Weekly Canned Fruit Notes.

Empire Marketing Board. Printed and published by His Majesty's Stationery Office.

This new weekly publication made its first appearance on 21st May, 1931. The Empire Marketing Board states "that the 'Notes' are to a certain extent experimental, but it is hoped to develop the service in course of time, particularly in regard to information as to shipments afloat of canned fruits and by the inclusion of information on canned vegetables and dried tree fruits."

The first three numbers of this publication have just arrived. They contain information regarding shipments and arrivals of canned fruit into the United Kingdom and various notes on recent developments and trade prospects which should be of very great value to pineapple packers and exporters in Malaya.

Interesting figures of the production of canned fruits in the United Kingdom are contained in the first number. In view of the possible effect of this industry on the future demand for Malayan canned pineapples, our local trade will doubtless wish to keep in close touch with developments in this direction.*

Information is also given concerning the production of citric acid from pineapple waste in Hawaii. It is stated that the cost of the plant is about £46,000 and it is expected to produce 3,000 lbs. of citric acid per day.

No mention is made of the cost of this publication. The Director of Agriculture is prepared to forward to the Empire Marketing Board a list of those who desire to receive future issues of *Weekly Canned Fruit Notes.*

D. H. G.

The Malayan Information Agency in 1930†

In this concise Annual Report evidence will be found of the continued usefulness of the Agency and it will be realised that a large part of its work, especially on the publicity side, has been concerned with agriculture.

In addition to the six month's exhibition at Antwerp, the Agency participated in nine other exhibitions. The main feature of the exhibits was Malayan canned pineapples and the increasing popularity of this product on the home market has undoubtedly been due in part to the activities of the Agency.

The many displays staged by the Agency at exhibitions, the wide use made of modern means of advertising such as the cinema, the increasing number of

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* In this connection the Malayan pineapple trade should obtain The Manchester Guardian and Commercial of May, 1931, which contains a special supplement of 12 pages on the British Canning Industry, price threepence plus postage, obtainable from the publishers.

† Report on the administration of the Malayan Information Agency for the year 1930. F.M.S. Federal Council Paper No. 19 of 1931.

contributions sent to the Press and the distribution of the attractive and informative literature of the Agency are factors which, doubtless, have contributed to the very satisfactory increase in the number of enquiries received during the year, which is the measure of the appreciation of the public of the facilities offered by the Malayan Information Agency.

D. H. G.

Fruits and Fruit Culture in the Dutch East Indies.

By J. J. Ochse. 180 p.p. 57 coloured plates, bibliography and index. G. Kolff Co. Batavia. 1931. Price guilders 17.50.

The publication in English of an illustrated survey of the more important fruits cultivated in the Dutch East Indies contributes a valuable addition to knowledge of local fruit production. With its diversity of soils and climatic conditions and large population the Dutch East Indies devote a considerable amount of attention to fruit culture. This important branch of horticultural science is controlled by the Horticultural Service of the Department of Agricultural, Industry and Commerce, at Buitenzorg, of which Service Mr. Ochse is Chief.

The book under review deals with some fifty fruits including recognised varieties of the banana, mango, pineapple and orange. The introduction contains a useful summary of what has been accomplished by the Department of Agriculture in assisting the fruit industry in Java. The fruits are treated in alphabetical sequence of their Natural Orders; by this means related species are grouped together and may be readily compared. The vernacular names used throughout the East are recorded together with reference to those names employed in Java and the Outer Provinces. A complete botanical description of each species is appended; the habit of the trees, foliage, flowers and fruit being described in detail. This is supplemented with information regarding the cultivation, uses, and observations on the individual fruits. Notes on the incidence of diseases and pests are given in the case of certain fruits. A notable feature is the excellent coloured plates of the fruits, flowers and foliage of each species described. The illustrations are faithfully reproduced in colour from drawings from nature and convey a true impression of each fruit.

The book is of considerable value to those engaged in the study of tropical fruits on account of the accurate nomenclature employed for the individual species. The results of practical experience with asexual propagation, particularly the use of seedling trees as stocks for budding desirable forms, will serve as a useful guide to the improvement of many local fruits in Malaya.

J. N. M.

Horticultural Abstracts.

Issued by the Imperial Bureau of Fruit Production, East Malling, Kent, England. Quarterly. Price 1s. 6d. per number or 5s. per annum post free.

This quarterly abstract Journal has arisen in response to the express desire of horticulturists from all parts of the Empire, culminating in the resolution adopted at the First Imperial Horticultural Conference held in London, August 1930.

Its aim is to collect under one cover summaries of the more important current horticultural literature, special emphasis being attached to fruit production, storage and allied subjects.

The first number of this publication is dated March 1931 and contains 109 abstracts. The ever-increasing number of publications renders a journal such as this of considerable value.

Recent Reports.

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE S.S. AND F.M.S. FOR THE YEAR 1930. By H. A. Tempany, Director of Agriculture. *31pp. Kuala Lumpur, F.M.S. Government Press, 1931.* This Malayan report is divided into two parts, the first dealing with Agriculture in Malaya, while the second part treats of the work of the Department of Agriculture for the year under review with summaries of the activities of each Division. A Staff List is included as an Appendix to the Report.

The Report forms a concise review of agricultural conditions during 1930 and of the scope and progress of the work of the Department during that period. Its method of presentation renders it more easily used as a document of reference than its predecessors.

CO-OPERATION IN MALAYA. The Report on the Co-operative movement in Malaya for the year July 1st 1929 to June 30, 1930 is contained in two separate reports, one dealing wth the co-operative movement in the Straits Settlements and the second on the working of the co-operative societies in the Federated Malay States.

The progress of the movement in the F.M.S. is shewn by the fact that the number of societies is now 158, an increase of 20 during the year with a total membership of 28,303. These societies have a paid-up share captital of $2,726,339 and a total working capital of $2,938,241, the increase in the total working capital during the year being $447,949.

The general economic condition of the country has rendered progress of Rural Credit Societies particularly difficult. Nine societies were struck from the register during the year and no new societies were formed. Thrift and Loan Societies shew a slight decline in membership but an increase in working capital. The progress of the Indian Estate Labourers' Co-operative Credit Societies is more encouraging reading. The general reduction of labour forces

on estates, however, resulted in a many members returning to India with their savings.

One Co-operative Rubber Factory was started at the end of the year under review and progress was made towards organising the small-holders at three other centres.

The Co-operative Department continued to carry out a considerable programme of propaganda with the object of instilling a better appreciation of the benefits of co-operation amongst small-holders.

The Co-operative work in the Colony is mainly concerned with Salary-earners' Societies, Rural Credit Societies and Indian Estate Labourers' Co-operative Credit Societies. The total number of societies at the end of the year was 42, an increase of 8 over the previous year, with a membership of 9,376 and a total paid-up capital of $567,473. an increase of $167.654. The greatest progress has been made in Salary-earners' Societies.

The reader gathers from these reports that the year has been a most difficult one for the co-operative movement. The Acting Director of Co-operation, who signs these reports, observes that "Co-operation is, however, more often than not the child of necessity, and the effect of lower prices is to increase the need for combination amongst small-holders" from which he thinks it possible that the small-holders "who paid little attention during the years of prosperity may be willing to give a readier ear to co-operative propaganda when times are hard."

THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE. PRINCIPAL'S REPORT FOR THE YEAR 1929—30. This is a record of the activities of the College which is concerned with courses of study of both a general and a special nature, besides research work connected with tropical crops.

The Principal (Mr. Geoffrey Evans, C.I.E.) states that the number of students taking the Diploma course is less than in the previous year. The smallness of the classes makes the cost of training correspondingly high, as the same staff has to be maintained and the same course of lectures delivered whether the classes consist of two men or twenty. The widespread depression in agricultural industry is resulting in the young men seeking openings in other professions, but it is hoped that with an improvement in the values of agricultural products, a renewed interest will arise in agricultural training and particularly in the facilities offered by this excellently designed course.

The research work at the College has been consolidated rather than extended. The long range research is confined to four main crop, namely, sugar-cane, cacao, bananas and citrus. The last two are of particular interest to Malaya and some account has already been given in these pages to the very valuable research work on bananas*. The report shews how closely the various

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*Review of "The Behavior and Diseases of Banana in Storage and Transport" *Malayan Agricultural Journal.* Vol. XIX No. 5, May 1931.

scientific departments of the College are working with the object of solving some of the main problems that beset tropical agriculturists.

The report points briefly to the lines of investigation, includes an imposing list of scientific papers published during the year, besides giving some account of the sugar factory and information on the general administration of the College. Under "General" are paragraphs concerning the work of special committees, some of which are of an advisory nature while others co-ordinate investigations on particular problems.

It is sometimes difficult for a new institution to find its exact place in the existing order of things. The Imperial College was started eight years ago in particular to satisfy the need of post-graduate training in tropical agriculture. The College has not only attained this object, but has managed to make considerable advances in scientific research and its economic application without over-lapping with the research work in progress at Departments of Agriculture in other tropical countries.

REPORT AND PROCEEDINGS OF THE SECOND INTER-DEPARTMENT AGRICULTURAL CONFERENCE. *Special Bulletin General Series No. 5 of the Department of Agriculture, S.S. & F.M.S. pp. 79. Price one dollar (Straits Currency).* A number of the papers read at this Conference, which was held at Kuala Lumpur at the end of October 1930, have since been published in the *The Malayan Agricultural Journal.* This new bulletin therefore presents a statement of the facts advanced by the introducer of each subject followed by a fairly full report of each ensuing discussion. It contains a most useful record of the resolutions adopted and of the views of a number of agricultural officers on a diversity of subjects. The subsequent work of giving practical effect to such resolutions will doubtless be much assisted by this Report.

D. H. G.

Departmental.

FROM THE DISTRICTS.

The Weather.

Generally speaking, the rainfall for the month on the West Coast and inland areas of Perak, Selangor and Negri Sembilan has been below normal for August. In Malacca, on the contrary, figures indicate that the heavy August rainfall usual for this area took place. It is interesting to record that the Malacca total figures of rainfall for the five months April to August were nearly double those for the same period of an average year.

Remarks on Crops.

Rubber.—The prices obtained by the small holder for his rubber have ruled appreciably lower during the month. The very great range in price persists, but the higher figures given in the following quotations are confined to special areas or to a quality of the produce well above the average. Quotations per pikul are, Smoked Sheet, \$5 to \$12; Unsmoked Sheet, \$5 to \$11; Scrap, \$1.50 to \$5.

Figures of first measurements made in connection with bark consumption investigation on small holdings have been received from a number of localities for record in the office at headquarters. Arrangements have been made for selecting and marking of holdings in Johore at an early date. Unfortunately up to the present it has not been possible to include Kedah in these investigations.

The further decline in price of rubber has resulted in an increase of untapped holdings in areas where owners possess padi lands as well, but where the owner relies almost entirely upon rubber for his livelihood the result has been a tendency to heavier and less careful tapping.

From all parts of the country reports have been received drawing attention to the increasing difficulty of maintaining the former standard of control for mouldy rot disease owing to the inability of many small holders to purchase the fungicides necessary for treatment and the impossibility, under present circumstances, of insisting upon a period of cessation of tapping during treatment. Consequently, where former standards of control have been proved impossible of attainment, efforts have been directed towards minimising the damage done to trees by the disease by periodic painting with an approved fungicide.

Padi.—In Province Wellesley cultural operations have been delayed on account of dry weather and consequent insufficiency of water in the fields. From the same cause the sowing of nursery beds has been delayed whilst, in the Dindings, a number of nurseries have failed. The dry weather extended to Krian, but here irrigation water has been adequate for requirements. In Bagan Serai mukim planting is nearing completion being, as usual, somewhat ahead of the rest of the district, although planting has commenced in all other mukims save that of Selinsing. Floods are delaying operations in Central districts of

Malacca and the coast mukims of Jasin district. The floods experienced in Malacca early in the month subsided rapidly and did little damage except in certain mukims of Alor Gajah and Jasin districts where some padi was destroyed. Transplanting is being done by plants obtained by division of the padi in undamaged blocks. Apart from the above noted incidents the crop generally shows good promise throughout the country.

Tobacco.—Interest in this crop is maintained in the Baling District of Kedah and in Province Wellesley, whilst the area continues to extend in Perak South and enquiries regarding the crop have been received from Johore. Some planting has also taken place in the Kuala Kangsar District of Perak.

It is reported from Kedah that although plants are well grown, curing methods are poor. The Rangoon type is not proving a success in Province Wellesley owing to early flowering and consequent low production of leaf. On the other hand the leaf is large and of good quality. The Jaffna type raised from seed supplied by the Department is proving one of the most successful in this Settlement for local requirements. During the month some 58 pikuls (3½ tons) of Province Wellesley grown and cured leaf was sold in Penang.

Present prices per pikul reported from Province Wellesley range from $40 to $43 for first quality and $25 to $30 for second quality. In Kedah, prices for dried but uncured leaf per pikul range between $12 and $20. It is reported from Kuala Kangsar that whole dried plants are being sold to local shops for from $40 to $60 per pikul.

Agricultural Stations and Padi Test Plots

Kedah.—Nurseries were sown at the Telok Chengai Rice Station and at the four Padi Test Plots.

At the Agricultural Station of Gajah Mati clearing and burning of jungle was in progress.

Province Wellesley.—Glugor Test Plot. The inter-season crop having failed, plants have been removed from the area and the land prepared for the main crop. Early sown varieties received their first transplantation and the shorter season varieties were sown. Planting is being delayed as long as possible to coincide with the time of this operation on surrounding lands.

Bukit Merah Padi Station.—The land at the end of the month was ready for planting the earliest sown varieties whilst the shorter season varieties were sown. The new irrigation channel is proving an asset to the Station as well as to cultivators of surrounding lands.

Perak.—(a) Agricultural Stations. Selama. Dry weather, causing the land to bake, has somewhat retarded the work of "lalang" grass eradication and preliminary cultivation of the land.

Kuala Kangsar.—Some crops, notably maize and tobacco, show uneven growth due apparently to uneven fertility of the soil. Virginia varieties of tobacco have made poor growth, but a locally obtained Chinese variety promises to prove more satisfactory. A fairly heavy crop of rambutans was produced

on selected trees and the seed has been sown to provide plants for sale and for stocks for future budding. Poultry selected for the purpose were despatched to the Bukit Fraser Station, thus providing the space required for increasing the stock of Rhode Island Red and for experiments with local fowls and cross breeds.

(*b*) *Padi Stations and Test Plots. Talang.* Preparation of land on the area set aside for manurial experiments has been in progress. An area for the comparative cultivation experiments has been demarcated and marked off into ¼ acre blocks. An area for banana manurial experiments has been chosen and the land is being tilled and marked off in accordance with an approved scheme.

Kamunting Slimed Area.—Final cultivation in readiness for planting next month is nearly complete.

Selinsing Cultivation and Manurial Trials.—Seedlings are in good condition and cultivation is completed, but planting is being delayed to fall in line with neighbouring lands where operations are less forward.

Bukit Gantang.—Dams have been repaired and clearing operations are in progress. Nurseries are in good condition.

Lenggong.—The long maturation Seraup padi strains were planted and the land prepared to receive the shorter season Radin varieties.

Bruas.—A rectangular block of 5 acres has been bunded off to form this new Test Plot in a manner to allow of a convenient lay-out for varietal trials on approved experimental lines. Seraup strains have been planted.

Selangor.—Cheras Agricultural Station. Plans for buildings and their sites have been approved by the Director. Progress on clearing the higher land has been made.

Kuang Padi Test Plot.—Plants are making satisfactory growth but stem borer infection is fairly heavy. Erection of the Agricultural Subordinate's quarters has been commenced.

Kajang Padi Test Plot.—A weeding was given. Water is somewhat scarce.

Negri Sembilan.—Rembau Agricultural Station. Work has started on the buildings. Preliminary cultivation is completed and seeds of cover crops have been obtained in readiness for sowing.

Rembau Test Plot.—Planting was completed.

Malacca.—(*a*) *Agricultural Stations. Sungei Udang.* Stumping and general clearing was continued. Holing for bananas and kapok was completed and nurseries prepared for coffee, arecanuts and pepper.

Jasin.—The site has been approved for a station in this district.

(*b*) *Padi Station and Test Plot. Pulau Gadong Station.* Planting was completed except for the very short season varieties. *Nymphula depunctalis* occasioned some slight damage to the Milek Puteh lines but were quickly controlled by an application of tuba root extract.

Alor Gajah Plot.—Planting of the late sown varieties was completed. The plants of the earlier sown varieties are making very satisfactory growth.

DEPARTMENTAL NOTES.

Obituary.

MOHAMED TAHARIM BIN ITAM JAFFAR.

With deepest regrets, we have to record the death, at the early age of 22, of Enche Mohamed Taharim bin Itam Jaffar, who passed away at Parit Buntar, Perak on 14th August, 1931, after a very brief illness.

Enche Taharim joined the Department of Agriculture in May 1928 as a Malay Apprentice and was promoted to Agricultural Assistant on the conclusion of his course of training in April, 1931. Throughout this period, his keen intelligence and aptitude for study placed him constantly at the head of his fellow-students and he gave every promise of becoming a most capable and trustworthy officer of the Department. He possessed a happy temperament which endeared him to his instructors and to all with whom he came in contact.

Our sincerest sympathy is extended to his father, Enche Itam Jaffar bin Ngah Merah, who has served as a Sub-Inspector of Coconuts in this Department for the past 28 years.

Tours of the Director.

The Acting Director of Agriculture visited Cameron Highlands from 4th—10th August when he attended daily meetings of the Cameron Highlands Development Committee, at which His Excellency The High Commissioner, Sir Cecil Clementi, G.C.M.G., was also present, from 4th to 7th.

Tea Factory at the Government Experimental Plantation, Serdang.

The new tea factory at the Government Experimental Plantation, Serdang, commenced operations during July. The factory is a permanent type of building, based on the latest Ceylon design, 60 feet long and 40 feet wide. Rolling, firing and sifting rooms are on the ground floor and a withering loft above. The machinery is driven by a 13 B.H.P. electric motor, working at 580 revolutions per minute.

The machinery so far installed comprises the following. One "Little Giant" tea roller having a capacity of 60 lbs. of withered leaf per charge. An improved tea roll-breaker fitted with beating apparatus and sieves. A 42 inch "Venetian" tea drying machine with a firing capacity of 45 to 50 lbs. of made tea per hour. An improved tea sifter, complete with three trays, 7 feet long. A single cylinder tea cutter, fitted with 3/8 inch cells. Exhaust fans are installed in the withering loft and sifting room.

The withering loft contains five series of 'tats' each complete 'tat' being 33 feet long by 7½ feet wide, with seventeen layers of hessian, providing a total withering space of 21,037 square feet, capable of holding about 1,400 lbs. of green leaf per wither.

Tea is now being manufactured and sold locally and it is intended to send representative samples to London and Colombo for valuation and report in the near future.

Retirement of the Raja Embeh bin Raja Abdul Majid and Enche Zebidin bin Datoh Sri Lela.

Raja Embeh bin Raja Abdul Majid, Malay Agricultural Assistant, Grade I, retired on pension on medical grounds on July 13th, 1931. This officer has spent over 20 years in the service of the Government, including 18 years as an officer of the Department of Agriculture. The whole of Raja Embeh's service was spent in the State of Selangor. He commenced work as a clerk in the Secretariat. His first appointment in the Department of Agriculture was to the post of Sub-Inspector of Coconuts on January 1st, 1913. He was in 1918 promoted to the departmental scheme for Malay Officers as a Junior Agricultural Assistant and was promoted to a Senior Agricultural Assistant in 1925.

Inche Zebidin bin Datoh Sri Lela, Malay Agricultural Assistant, Grade I, retired on pension on medical grounds on August 27th, 1931, after completing 22 years service in the Department of Agriculture. He commenced his career in the Department as a Sub-Inspector of Coconuts on August 8th, 1909, and was placed on the departmental scheme for Malay Officers on July 1st, 1919, being promoted to a Senior Agricultural Assistant on July 1st, 1922. He acquitted himself very creditably in all the departmental examinations which he was required to undergo and applied himself seriously to his work, so that he became a very efficient inspection officer. In 1925 he suffered from a serious illness and owing to subsequent poor health it has been increasingly difficult for him to perform his duties in the very efficient manner that he did prior to his illness.

The Chief Agricultural Field Officer visits Negri Sembilan, Malacca and Perak.

The Chief Field Officer visited Malacca on August 13th, 14th and 15th and Negri Sembilan on August 16th and 17th to inspect the work of the various Experimental Stations and to discuss administrative details with officers concerned.

He paid a short visit to Perak between August 20th and 22nd. visiting Taiping, Kuala Kangsar and Tapah. His visit was mainly connected with arrangements for future development work in connection with Agricultural Stations and Padi Test Plots in that State.

I. S. P. Conference.

The Incorporated Society of Planters held a Conference at Port Dickson on 15th and 16th August, 1931, at which the Acting Director of Agriculture (Mr. F. W. South) delivered a lecture on "Agricultural Products in Malaya" and the Plant Physiologist (Mr. W. N. C. Belgrave) a lecture on "Soil Surveys in Malaya".

Statistical.

MARKET PRICES.

August, 1931.

Rubber.—The price of rubber fell steadily throughout the month, in Singapore from 8½ cents per lb. to the record low price of 7¼ cents per lb. and in London from 2⅝d per lb. to the new low record price of 2¼ cents per lb. The average price for the month for R.S.S. equal to London standard was 7.3 cents per lb., while the London average price was 2.4 d. per lb. as compared with 9.7 cents and 3d respectively for July.

Palm Oil.—Our Singapore correspondent reports that the London price of palm oil for C.I.F. August/September was £14.5.0.

Copra.—The Singapore market for Sundried copra had little features of interest during the month. Demand increased somewhat about the middle of the month but prices subsequently sagged. The average price of Sundried for August was $4.21 per picul as compared with $4.70 per picul in July. "Mixed" copra was 30 cents below the price of "Sundried" throughout the month.

Coconut Oil.—The average wholesale export price of coconut oil in Singapore for August was $9 per picul. The market for this class of oil has been weakened by the gradual reduction in the price of copra which indicated to consumers that the price would eventually drop. On account of general trade conditions the market has been cautious and there is little likelihood of a recovery unless general market conditions improve in other directions. Copra cake averaged $1.87 per picul for the month, the price having risen from $1.75 to $2.00 during the second half of the month.

Gambier.—Prices have shewn but little variation in Singapore; Block averaged $9.56 per picul and Cube No. 1 $17.25 per picul for the month, compared with $10 and $19 respectively in July.

Rice.—The average declared trade value of imports of rice during July was $3.54 per picul, compared with $3.67 per picul in June. The retail market price in cents per gantang of No. 2 Siam rice in July was Singapore 30, Penang 25, Malacca 27, as compared with 30, 28 and 25 respectively for June.

The padi position in Rangoon is reported to be getting firmer daily; stocks are well held and prices are advancing steadily. A rice shortage is reported in Shanghai owing to a stoppage of rice-shipments from Yangtze cities on account of floods. A definite rise in padi price took place in French Indo-China during July. Stocks in hand were short early in the month, increasing later.

There appears little fear of a rice shortage as crops have generally been good in the main rice-producing countries and the demand from the chief rice-importing countries below normal, resulting in some accumulation of stocks.

Arecanuts.—Singapore prices show a further decline over those of July. Palambang Whole averaged $3.47 per picul against $4.17 in July and Bila Whole $3.44 as compared with $3.64 for the previous month. For other grades,

the average prices were as follows :—Sliced $4.87 to $14.62; Split $4.12 to $5.69; Red Whole $6.75 to $7.34; Kelantan Split $5.41 to $5.81—all per picul, the price within each range depending upon quality.

Coffee.—Average Java Robusta prices varied from $14.25 to $16.70 per picul, the prices within these limits depending upon quality. These prices compare with $17.62 to $19.06 per picul for the previous month and indicate an unsatisfactory market. The average Singapore price for Palambang coffee was $11.44 per picul as compared with $12.79 for July.

Pineapples.—Very little business is passing, but production is now negligible and dealers do not press sales. Average prices per case in Singapore during August were :—1½ lb. cubes, $3.44; 1½ lb. sliced flat, $3.28; 1½ lb. sliced tall, $3.39 as compared with $3.48; $3.35 and $3.51 during the previous month.

Tapioca.—Market mostly dull with buyers holding off for lower prices. Singapore average prices per picul for August were :—Flake, fair, $3.32; Pearl. seed, $4.19; Pearl, medium, $4.42 as compared with $3.37; $4.43 and $5.00 respectively for July.

Sago.—Moderate transaction are reported in a quiet but steady market. Average Singapore prices per picul during August were :—Pearl, small fair, $4.25 as compared with $4.39 in July; Flour, Sarawak fair, $1.78 as compared with $1.84 in July.

Pepper.—Prices remained steady for the greater part of the month, but with supplies coming in freely the market closed the month dull and prices tend to decline. Average Singapore prices per picul in August were :—Singapore Black, $18.19; Singapore White $27.25; Muntok White, $28.37. Corresponding prices in July were :—$19.20; $30.80; $31.45.

Cloves.—The market calls for no comment. Prices quoted in Singapore throughout August were :—Zanzibar $43; Amboina $48 as compared with average prices of $46.60 and $49.40 respectively for July.

Mace.—Market steady though the demand is negligible. Singapore average prices for August were as follows :—Siouw $56.50; Amboina $38.75 as compared with $56.10 and $39.30 respectively in the previous month.

Nutmegs.—Demand is small with values declining a little. During August, 110's averaged $20.87 per picul in Singapore as compared with an average price of $23.80 for July; 80's averaged $27.37 per picul as compared with $33.80 for July.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in August and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd.; reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore, and a report on the coconut oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs. The dollar is fixed at two shillings and four pence,

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

COCONUT AND PALM OIL PRODUCTION IN MALAYA

Net exports 1930 and first half year 1931.

Product.	Year 1930		Jan. 1 to June 30 1930		Jan. 1 to June 30 1931	
	Net Exports Tons	Value $	Net Exports Tons	Value $	Net Exports Tons	Value $
Coconuts, fresh ...	10,478	406,921	4,963	216,552	3,803	99,726
Copra ...	102,014	15,307,511	40,094	6,928,923	41,126	4,384,022
Coconut Oil ...	9,473	2,359,357	4,992	1,334,494	4,957	869,703
Palm Oil ...	3,211	892,995	1,334	374,403	1,825	483,246
Palm Kernels ...	485	80,792	205	35,251	282	44,546

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JULY, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	during the month: Foreign	during the month: From Malay States	during the year 1931: Foreign	during the year 1931: From Malay States	during the month: Foreign	during the month: Local	during the year 1931: Foreign	during the year 1931: Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES:—																		
Federated Malay States	...	13,679	13,512	12,723	80,206	8,056	60,065	Nil	Nil	Nil	26	12,107	7,458	90,221	49,327	14,217	14,174	..
Johore	...	2,301	3,769	3,737	24,619	3,881	27,231	Nil	4	Nil	16	906	6,551	5,321	47,156	2,305	3,930	...
Kedah	...	395	2,215	2,385	14,405	956	7,284	Nil	Nil	Nil	Ni	579	2,614	4,267	17,713	411	2,347	...
Perlis	...	9	6	8	52	5	71	Nil	Nil	Nil	Nil	Nil	13	Nil	129	11	4	..
Kelantan ...	..	208	156	170	1,210	601	3,020	5	Nil	17	Nil	56	656	486	3,747	262	166	..
Trengganu ...	..	55	50	128	708	64	354	Nil	Nil	Nil	Nil	Nil	192	Nil	1,062	55	50	..
Total Malay States	...	16,647	19,708	1,9151	121,200	13,563	98,025	5	4	17	42	13,648	17,484	100,295	119 134	17,261	20 671	...
STRAITS SETTLEMENTS																		
Malacca ...	...	3,025	1,389	1,382	8,401			Nil		Nil		3,923		31,841		3,209	1,448	...
Province Wellesley	...	133	595	549	3,130			Nil		Nil						130	545	.
Dindings ...	...	116	109	105	660	(2) 2,128	(2) 13,316	Nil	17,530	Nil	119427		Nil		Nil	115	121	...
Penang	1,475	5,139	6	8	52			554		4,867		5,390		41,719		5,360	9	2,247
Singapore ...	4,440	33,626	298	176	1,264			9,097		58,016		20,697		128,903		33,835	322	5,125
Total Straits Settlements	5,915	42,066	2,397	2,220	13,507	2,128	13,316	9,651	17,530	62 883	119,427	30,010	Nil	202,463	Nil	42,649	2,445	7,372
TOTAL MALAYA	5,915	58,713	22,105	21,371	134,707	15,691	111,341	9,656	17,534	62,900	119 469	43,658	17,484	302,758	119 134	59 910	23,116	7,372

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	11,528	31,099	4,976	3,253	906	51,762
WET RUBBER	2,689	2,736	384	201	1,399	7 409
TOTAL ...	14,217	33,835	5,360	3,454	2,305	59,171

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	30,509	199131
Penang ...	8,267	67,487
Port Swettenham.	4,641	32,554
Malacca ...	241	3,186
MALAYA ...	43,658	302758

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	33,842	240639
MALAYA ...	33,842	240639

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. *i. e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] estimated—[2]—[3]—[4]—[5]—[9]—[10] For the Straits Settlements, the figure represents purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay State, being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics S.S. and F.M.S., at Singapore on 22nd August, 1931.

Budgrafted Rubber S.S. & F.M.S.

TABLE I.

BUDGRAFTED ESTATES, BY ACREAGE AND SIZE OF HOLDING, AT END OF 1930.

Territory	In areas of over 1,000 acres each		In areas of between 500-1,000 acres each		In areas of between 100-500 acres each		In areas of between 50-100 acres each		In areas of between 10-50 acres each		In areas of under 10 acres each		Total Number of Bud-grafted areas	Total Acreage of Bud grafted areas
	No. of Areas	Total Acreage	No. of Areas	Total Acreage	No. of Areas	Total Acreage	No. of Areas	Total Acreage	No. of Areas	Total Acreage	No. of Areas	Total Acreage		
Federated Malay States—														
Perak ...	...	...	1	537	18	3,517	9	619	20	497	18	70	66	5,240
Selangor ...	3	10,469	7	5,573	27	6,128	16	1,072	24	607	13	50	90	23,899
N. Sembilan ...	4	8,228	4	3,029	26	6,525	7	575	15	342	7	22	63	18,721
Pahang ...	1	2,474	...	...	3	1,041	3	192	5	161	2	8	14	3,876
Total, F.M.S. ...	8	21,171	12	9,139	74	17,211	35	2,458	64	1,607	40	150	233	51,736
Straits Settlements—														
Province Wellesley ...	...	...	...	...	1	262	...	...	3	85	4	24	8	371
Dindings ...	...	...	1	730	...	...	...	...	...	...	...	...	1	730
Malacca ...	1	1,366	...	...	10	2,535	2	122	3	55	5	25	21	4,103
Penang ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Singapore ...	...	...	...	...	...	...	...	...	1	20	1	5	2	25
Total, S.S. ...	1	1,366	1	730	11	2,797	2	122	7	160	10	54	32	5,229
S.S. & F.M.S. ...	9	22,537	13	9,869	85	20,008	37	2,580	71	1,767	50	204	265	56,965

NOTE · For the Unfederated Malay States, the information is not at present available.

TABLE II.

BUDGRAFTED ESTATES BY YEARS BUDGRAFTED AND AREA IN TAPPING AT THE END OF 1930. AS DECLARED BY ESTATES OF 100 ACRES AND OVER

Territory	Year of Budgrafting									Total area Budgrafted at the end of 1930	Total area of Budgrafted Rubber in Tapping
	1922 or earlier	1923	1924	1925	1926	1927	1928	1929	1930		
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Federated Malay States—											
Perak ...	1,127	36	48	...	96	215	433	1,038	2,247	5,240	1,167
Selangor ...	1,058	519	377	232	727	1,072	2,074	7,784	10,056	23,899	2,075
N. Sembilan ...	...	25	120	187	...	942	4,330	6,151	6,966	18,721	127
Pahang ...	...	...	...	...	...	15	108	2,695	1,058	3,876	...
Total, F.M.S. ...	2,185	580	545	419	823	2,244	6,945	17,668	20,327	51,736	3,369
Straits Settlements—											
Province Wellesley ...	...	...	...	..	...	...	5	45	321	371	...
Dindings ...	194	...	...	85	101	250	...	100	...	730	192
Malacca ...	...	...	57	51	92	348	689	2,056	810	4,103	...
Penang ...	...	...	...	...	...	...	...	...	...	...	...
Singapore ...	...	...	...	...	..	...	5	3	17	25	...
Total, S.S. ...	194	...	57	136	193	598	699	2,204	1,148	5,229	192
Grand Total, S.S. & F.M.S.	2,379	580	602	555	1,016	2,842	7,644	19,872	21,475	56,965	3,561

NOTE: For the Unfederated Malay States, the information is not at present available

TABLE III.

BUDGRAFTED ESTATES BY AREAS OF PROVEN AND UNPROVEN CLONES AT THE END OF 1930, AS DECLARED BY ESTATES OF 100 ACRES AND OVER

Territory	Proven Clones	Unproven Clones. (Estates own nurseries)	Total
	Acres	Acres	Acres
FEDERATED MALAY STATES—			
Perak	3,764	1,476	5,240
Selangor	21,923	1,976	23,899
Negri Sembilan	17,867	854	18,721
Pahang	3,842	34	3,876
Total F.M.S. ...	47,396	4,340	51,736
STRAITS SETTLEMENTS—			
Province Wellesley	366	5	371
Dindings	300	430	730
Malacca	3,201	902	4,103
Penang	...	...	...
Singapore	25	...	25
Total S.S. ...	3,892	1,337	5,229
Grand Total S.S. & F.M.S. ...	51,288	5,677	56,965

NOTE: For the Unfederated Malay States, the information is not at present available

D. H. GRIST,
Acting Deputy Registrar-General of Statistics
S.S. and F.M.S.

Rubber Areas Untapped for each of the months — April, May, June and July 1931 in the Federated Malay States and Straits Settlements.

(Estates of 100 Acres and over)

STATE OR TERRITORY	AREA UNTAPPED (ACRES)								TOTAL AREA UNTAPPED*			
	Total areas of Estates which have entirely ceased tapping				Areas on Estates partly out of tapping (Pro-tem)							
	April	May	June	July	April	May	June	July	April	May	June	July
Perak	7480	5308	6290	6847	28588	27177	28329	29311	36068	32485	34619	36158
Selangor	13804	9959	10339	10741	35591	35633	37260	39264	49395	45592	47599	50005
N. Sembilan	10094	9493	12375	14035	25314	30089	29377	22902	35408	39582	41752	36937
Pahang	5996	6420	6348	6294	4561	4807	5041	4979	10557	11227	11389	11273
Total F.M.S. ...	37374	31180	35352	37917	94054	97706	100007	96456	131428	128886	135359	134373
P. Wellesley	3861	2934	2192	3085	7438	11448	7974	7551	11299	14382	10166	10636
Dindings	659	—	—	—	1186	1677	1569	1713	1845	1677	1569	1713
Malacca	3673	5026	3909	4650	17411	20764	21495	20862	21084	25790	25404	25512
Penang Island	747	642	747	747	393	165	173	170	1140	807	920	917
Singapore Island ...	6902	8642	8658	9576	7573	6222	5969	6033	14475	14864	14627	15609
Total S.S. ...	15842	17244	15506	18058	34001	40276	37180	36329	49843	57520	52686	54387
Total F.M.S. & S.S. ...	53216	48424	50858	55975	128055	137982	137187	132785	181272	186406	188045	188760

Rubber Areas rested due to the adoption of A.B.C. and similar systems of tapping in each of the months April — July 1931.

	April	May	June	July
F.M.S. ...	36598	33648	35966	36600
S.S. ...	13969	8023	11084	10841

* Not including areas untapped owing to the adoption of A.B.C. or similar schemes of periodic tapping.

GENERAL RICE SUMMARY *

July, 1931.

Malaya.—The net imports of rice into Malaya for July amounted to 45,985 tons, of which 48 per cent. was from Siam, 48 per cent. from Burma, 3 per cent. from French Indo-China and 1 per cent. from other countries.

The total imports of rice into Malaya for the first seven months of 1931 were 407,000 tons, net imports being 308,000 tons, or 40,000 tons less than for the corresponding period of 1930.

Stocks of padi and rice held by wholesale dealers and millers in the S.S. and F.M.S. at the end of June were :—padi 14,645 tons, rice 24,277 tons. These stocks converted to padi at 62 per cent., together with estimated stocks in Johore, on estates, and for retailers on the S.S. and F.M.S. amounted 46,196 tons of rice.

The padi reports, including reports for each of the Unfederated Malay States, indicate that work for the new season, 1931—32 is in hand in all areas.

India.—Total foreign exports of milled rice for the first half year 1931 were 1,246,000 tons, a decrease of 589,000 tons as compared with the corresponding period of 1930.

It is reported that the Burma exports of rice and rice products from January 1st to July 11th, 1931, were 2,316,261 tons being a decrease of 6.7 per cent. as compared with the figures for the corresponding period of 1930.

China.—Imports of rice into China in 1930 were 648,270 tons as compared with 644,214 tons in the previous year.

Japan.—Stocks of rice in Japan (Proper) on July 1st, 1931, were 3,666,484 tons, being an increase of 19.6 per cent. as compared with the stocks on the same date in 1930. Of these stocks, 556,265 tons were held by Government and 3,110,219 tons by private persons.

The rice supply for the 4 months to end of October 1931 will be 3,982,188 tons and the demand 2,822,440 tons, leaving a balance of 1,159,748 tons to be carried forward for the next season.

Siam.—Exports of rice from Bangkok from December 1930 to June 1931 were 732,488 tons, an increase of 36,019 tons or 5.2 per cent. as compared with the same period of the previous year and a decrease of 115,159 tons, or 13.6 per cent. as compared with the average of the same period for the past five years.

It is reported that that there has been an increased demand from Singapore and Hongkong.

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* The following is an abstract of the General Rice Summary for July 1931, compiled from various sources by the Registrar-General of Statistics, S.S.

Java, Madura and N.E.I.—At the end of June 1931, the area harvested amounted to 6,750,000 acres, a decrease of 93,000 acres as compared with 1930.

Imports into Java and Madura, January to June 1931 were 154,000 tons as compared with 189,000 tons in 1930, and the imports into the Outer Provinces, January to May 1931, were 144,000 tons as compared with 163,000 tons the previous year.

French Indo-China.—Exports of rice from Saigon (January 1st to July 1931) were 651,000 metric tons as compared with 777,000 metric tons in 1930.

Estimated production of rice in Cochin-China (1930—31) was 1,812,700 tons, being 15.3 per cent. less than the previous year and 16.5 per cent. below the average of the five years ending 1928—9, and the total crop (1930—31) of Indo-China 5,787,370 tons as compared with 5,896,610 tons the previous year, or a decrease of 1.9 per cent.

Ceylon.—Imports January to June 1931, inclusive, were 211,991 tons as compared with 244,226 tons in 1930.

Europe.—The quantities of rice shipped from the East were :—

A. To Europe, period January 1st. to July 16th, 701,000 tons, an increase of 40.5 per cent. as compared with 1930.

B. To the Levant, period January 1st. to June 16th, 23,000 tons, an increase of 76.9 per cent. as compared with 1930.

C. To the West Indies and America, period January 1st. to June 2nd, 96,000 tons, a decrease of 11.1 per cent. as compared with 1930.

Egypt.—It is reported that there will be a deficit in the Egyptian crop, this year owing to lack of water and that the crop will amount to only 10 per cent. of the normal crop which is between 200,000 and 300,000 tons of clean rice. The existing stock of Egyptian rice is estimated at 80,000 tons and it is considered that an import of about 100,000 tons will be required to make up the shortage in the crop.

Philippines.—The production of rough rice (1930—31) is estimated at 2,008,000 tons as compared with 2,188,000 tons (actual) in the previous year.

METEOROLOGICAL SUMMARY, MALAYA. JULY, 1931.

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day Amt.	Number of days: Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Pe cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	89.4	71.3	80.3	92	67	85	74	84.0	85.1	5.92	150.4	1.32	15	13	3	5		203.85	6.58	53
Bukit Jeram, Selangor ...	88.1	72.3	80.2	90	71	85	75	84.3	86.6	3.45	87.6	1.48	15	11	5	1		221.00	7.13	58
Sitiawan, Perak ...	89.1	72.3	80.7	91	70	85	75	84.0	84.8	5.98	151.9	1.72	15	14				210.80	6.80	
Kroh, Perak ...	85.2	69.7	77.5	88	66	80	72	81.7	82.8	8.38	212.9	2.40	15	14	2	6		188.65	6.09	
Temerloh, Pahang ...	89.4	72.4	80.9	92	71	85	75	84.9	86.4	5.83	148.1	2.17	14	9	4	11		190.20	6.14	50
Kuala Lipis, Pahang ...	88.3	70.3	79.3	91	68	82	72	83.1	84.3	12.86	326.7	2.27	20	19	19	20		170.65	5.50	45
Kuala Pahang, Pahang ...	86.8	73.4	80.1	89	71	83	76	84.4	85.6	7,29	185.2	1.63	18	14	2		1	226.45	7.30	60
Mount Faber, Singapore ...	87.3	76.1	81.7	92	72	78	79	82.2	83.7	6.94	176.3	1.47	15	12	1			184.10	5.94	49
Butterworth, Province Wellesley ...	87.1	73.6	80.3	90	71	83	77	84.7	85.6	5.28	134.1	1.42	13	11			1	215.00	6.94	
Bukit China, Malacca ...	84.4	76.3	80.3	86	71	81	75	82.2	83.6	15.69	398.5	3.26	23	20	9			194.75	6.28	51
Kluang, Johore ...	86.9	71.4	75.5	91	69	81	73	81.6	82.8	6.19	157.2	1.93	19	14	1	5		169.65	5.47	45
Bukit Lalang, Mersing, Johore	88.2	71.9	80.1	91	70	80	74	82.7	82.9	8.06	204.7	2.60	13	10	1			205.35	6.62	54
Alor Star, Kedah ...	87.3	74.2	80.7	90	72	81	76	86.5	86.8	4.57	116.1	1.62	17	14				210.65	6.79	55
Kota Bahru, Kelantan ...	89.5	73.5	81.5	92	72	84	76	85.5	85.9	5.01	127.4	1.21	15	11				233.30	7.53	61
Kuala Trengganu, Trengganu	89.3	72.5	80.9	92	71	83	74	84.1	85.6	5.31	134.9	3.59	12	10		1		234.65	7.57	61
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.8	59.0	65.4	76	57	69	61			5.29	134.4	1.32	21	16				172.65	5.57	45
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.3	55.9	64.1	76	51	70	61	71.1	70.6	4.73	120.1	1.00	21	17				164.85	5.32	43
Fraser's Hill, Pahang 4268 ft.	74.3	61.8	68.1	78	60	71	64	71.3	72.2	4.72	119.9	1.27	20	5	2	22		194.75	6.28	51

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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The Director, Rubber Research Institute.
The Director of Co-operation.
The Principal, Sultan Idris Training College.
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The Director of Agriculture (Chairman)
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Coconut & Oil Palm Research Committee.

The Publicity Committee.

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OCTOBER, 1931.

EDITORIAL

Mining and Agriculture.

In some parts of the world special measures have been taken and legislation enacted, with the object of ensuring that areas from which minerals have been extracted shall be left in a condition suitable for agricultural purposes. In the case of dredging for minerals, a usual manner of reconditioning the soil is to remove the top fertile layers and replace them in approximately their original position after the land has been worked. In Malaya little has been done in respect of this matter, as is evidenced by the areas of mine tailings to be found in various parts of the country. When it is realised that these mine tailings are generally worthless for agricultural purposes, not only at the present time, but are likely to remain infertile for the better part of a century, it will be seen that there is some cause for the fairly widespread opinion in Malaya that mining and agricultural interests are definitely antagonistic by reason of the above facts and also on account of the silting of the rivers.

Experience in other countries has shewn that the waste of land that has taken place in Malaya is not a necessary concomitant of the recovery of minerals from the soil by dredging. Even in Malaya there are a few instances of dredged lands that have been treated with the object of leaving a soil that can be rendered suitable for agricultural purposes. In such cases the method has been to settle a layer of "slimes" over the dredge tailings. Indications are not wanting that land so treated can be rendered suitable for the growth of a number of agricultural crops in a comparatively short time, although, apart from the experiments with padi described in an article in this issue, no definite tests can be quoted in proof of the statement. Experiments with other crops are, however, contemplated.

Ability to grow padi on dredged and slimed lands is of particular interest, as dredged land can be left in a manner specially suitable for convenient irrigation. Should it be proved that such land can be made to produce heavy crops of padi, it is not an impossible conjecture that some existing padi areas which cover tins deposits might be improved with respect to ease of irrigation by being dredged and reconditioned. In this way mining interests, in certain cases, may yet prove to be distinctly helpful, instead of antagonistic to agricultural interests.

Coconut Harvesting. Careful investigation of each operation in the preparation of copra is being undertaken by this Department with the object of improving the colour, oil content and of the yield per acre.

The progress of this work has been published from time to time in this Journal. Readers will realise from these accounts that the investigator is unable to recommend any one method the adoption of which would revolutionise the local industry, but he has pointed the road towards better production by the observance of a number of precautions which cumulatively should bring about improvements in yield and quality which it is hoped will eventually be reflected in enhanced prices.

In an article included in this number, Mr. F. C. Cooke discusses his work on the harvesting of coconuts for copra production. A consideration of the arguments advanced by the writer points to conclusions, the more important of which are; firstly that the highest yield of oil and copra is obtained at the time of natural nut fall and secondly, that the harvesting of nuts in different stages of ripeness seriously affects the quality of copra by reason of the fact that the mixing on a kiln of unripe coconut meat with ripe and over-ripe meat results in an irregularly dried product, which means that while some of the copra will be over-dried and discoloured other pieces will be insufficiently dried and therefore open to the attack of moulds.

We have stressed the importance of effecting improvements in copra production. The planter is perhaps less concerned with this subject because he has found in practice that the buyers do not offer an enhanced price commensurate with the extra expense of producing good copra. At the risk of reiteration we would point again to the possibility that increased world production of copra on an over-stocked oil market may at any time make the home buyers more selective in the purchase of their requirements and that poor quality copra might thereby become unsaleable.

Furthermore, and to our mind a very much greater argument in favour of the adoption of better methods of harvesting and preparing copra, this research work indicates that the adoption of more scientific harvesting of coconuts and more care in the preparation of the copra tends towards higher yields of copra with consequent reduction of costs. It is perhaps on the realisation of this increase of crop that the future of the industry depends and therefore if for no other reason, we recommend the "tightening up" of the harvesting methods on coconut estates of Malaya.

Fish Culture Following an article on the rearing of carp in ponds by Mr. W. Birtwistle, Officer-in-Charge, Fisheries Department, S.S. and F.M.S., which appeared in the August number of this Journal, the same author contributes to the present number an article giving an account of the methods employed by the Chinese in catching the carp fry in China and transporting them to Singapore.

The subject if of more than academic interest as not only is the trade considerable, but the expense involved is great on account of the very personal supervision entailed and the high mortality amongst the fry in spite of all precautions.

The author shews the possibilities of considerable economies in transport by the adoption of oxygenated water and by the employment of inexpensive apparatus which should appeal to the class of Chinese who are mainly responsible for introducing carp fry into Malaya.

Manuring of Oil Palms.

Our knowledge of the manurial requirements of the oil palm is restricted by the fact that its history as a plantation crop is very short, while it takes many years to establish a thorough knowledge of the manurial requirements of the crop.

Mr. C. D. V. Georgi contributes to this number an article on the "The Removal of Plant Nutrients in Oil Palm Cultivation" which, while not attempting to prove the manurial requirements of the crop, yet shows that a considerable amount of plant nutrients may be removed from the land by the leaves, male inflorescences, and fruit bunches of oil palms. Neglect to return to the soil all the waste organic material removed with the crop may therefore, in after years, result in very serious mineral impoverishment and entail considerable additional expense in manuring.

The reader is warned, however, that the estimation of plant nutrients removed by a crop cannot be used as a guide to manuring.

Original Articles.

RECLAIMING OLD MINING LAND FOR AGRICULTURE

BY

F. Birkinshaw,

Agricultural Field Officer, Perak North.

The Dredged lands of Malaya.

Dredging has become one of the most common methods of obtaining tin ore in Malaya. Up to the present no attempt has been made in this country to re-condition land so dredged by first removing the top soil and then replacing it after the land has been worked.

A very large proportion of the soil left behind by tin dredges consists of coarse particles almost totally devoid of humus, most of the fine particles and practically all the vegetable matter generally being removed in the process of dredging and washing to obtain the tin ore.

Such soil is practically worthless for agricultural purposes It remains in this state for a considerable period and cannot be rejuvenated economically on a large scale by any known method.

It can probably be accepted that for fifty years, or even a century after being deposited, the majority of dredge tailings † in Malaya are unlikely to be converted by natural means even into a moderately good medium for plant growth.

The Mining Enactment of the Federated Malay States requires that the effluents from mines which flow into the rivers shall not contain more than 800 grains of slimes per gallon. To comply with this requirement it is generally necessary to settle out a proportion of the slimes* on land before the effluent is discharged into the rivers. Frequently, the settling out of slimes on an area set aside for the purpose is necessitated to conserve sufficient water to float and work the dredge. In some cases alum or other flocculant is used to effect settlement of slimes. Slimes usually contain very little, if any, vegetable matter.

It will be seen, therefore, that a proportion of the fine soil particles or slimes is frequently retained, but these are generally settled in one or more restricted areas and are not spread over the whole of the area worked.

A few exceptions exist where the slimes are settled more or less evenly over a large part of the worked land, either because it is convenient and economical

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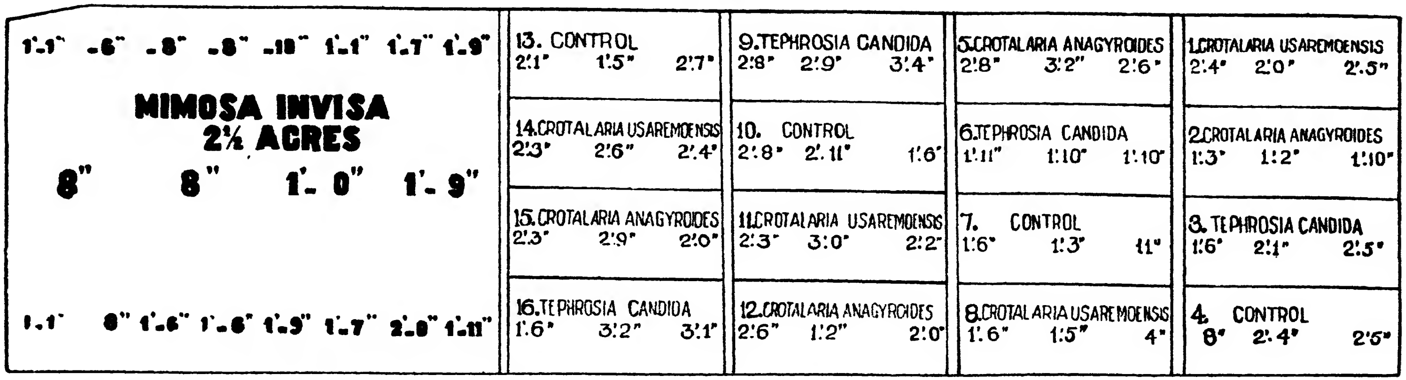
† Dredge tailings. In the case of tin dredging the refuse left behind after removal of the ore. Composed mainly of coarse particles. Most of the fine particles are removed in suspension in the water used to wash the soil from the ore.

* Slimes. The fine soil particles (which are removed in suspension in the water used for washing the soil from the heavy crude ore), when settled out are termed slimes.

Crop of padi grown on reclaimed mining land.

PLAN OF EXPERIMENTS AT KAMUNTING ON SLIMED LAND



NUMBERED PLOTS, EACH ONE ACRE, SOWN ON AUGUST 22ND AND 24TH 1925. LARGE AREA OF 2½ ACRES SOWN WITH MIMOSA INVISA AT 6'x 6' ON DECEMBER 20TH 1926. FIGURES, OTHER THAN PLOT NUMBERS, REFER TO DEPTH OF SLIMES.

SCALE ——— = 1 CHAIN.

to do so, or because special conditions have been entered in the mining lease requiring that it be done.

The conversion of either dredge or open-cast mine tailings into a fertile soil is as yet an unsolved problem. There are reasons for supposing, however, that if these tailings are covered with a sufficiently deep layer of slimes it is possible, within a reasonable period, to convert the land into a medium that will successfully support a variety of crops. Very little definite information is available as to the optimum depth of slimes for any particular agricultural purpose, or to what extent the optimum depth may vary in accordance with the type of soil mined.

Preliminary Experiments.

In July 1922 Mr. F. H. Nash, an Officer of the Mines Department, Federated Malay States, who was at the time specially detailed for investigation in connection with dredging problems and stationed in Taiping, approached the Assistant Agricultural Inspector, Perak North, on the question of re-conditioning dredged lands and rendering them suitable for agricultural purposes.

The first step was obviously to ascertain the best and cheapest means of supplying the deficiency of humus in the slimes The growing of green dressings suggested itself as probably the best way of providing this humus. In May, 1923, two Dredging Companies kindly agreed to provide land and facilities for experiments. One area was chosen at Kota on land that was dredged in 1917 and used as a settling area up to 1922, the slimes being about five feet in depth Another area was selected at Kamunting which was dredged and slimed at the end of 1916 This area had been worked previously by Chinese miners over a period of about nine years i.e. between 1905 and 1914. The slimes varied in depth from 9 inches to about 2 feet. In September, 1923, a further area was selected near Batu Gajah.

It was necessary in the first place to ascertain the plants that would grow on the slimes and it was recognised that it was desirable to find a plant that could be cheaply and easily established and which would, with little or no attention thereafter, continue to make good growth or regenerate itself by self seeding.

In small scale preliminary trials the following plants were used:—(1) *Mimosa invisa* (2) *Tephrosia candida* (3) *T. purpurea* (4) *T. Hookeriana* (5) *Crotalaria striata* (6) *C. usaremoensis* (7) *Sesbania aculeata* (8) *Cajanus indicus* (9) *Centrosema Plumieri* (10) *Stizolobium niveum* and (11) *Vigna Catjang.* The heavy and recently settled slimes needed very efficient drainage to enable any of these plants to thrive. Plants were sown in clumps at various distances apart in order to ascertain the maximum distance that could be employed.

The only plants in the above list that appeared suitable for the purpose were *Mimosa invisa, Tephrosia candida, Crotalaria usaremoensis* and *C. striata.* It

was ascertained that *Mimosa invisa* would cover the land completely with a dense growth if sown in clumps at 6 feet x 6 feet. *Tephrosia candida* was slower in becoming established, but thereafter maintained a good growth. A satisfactory planting distance was found to be in clumps 4 feet x 4 feet. This plant stood pruning well; the prunings were left to rot on the ground. *C. usaremoensis* proved the more promising plant of this genus. Neither of the two species used is a perennial, but there were indications that both might successfully regenerate themselves by self seeding. None of the herbaceous twiners tried made satisfactory growth.

Main Experiments.

In August 1925 an area of four acres was fenced at Kamunting and divided into sixteen plots; twelve were sown with *Tephrosia candida, Crotalaria usaremoensis* and *C. striata* and four control plots were left unplanted. Germination of seed was poor owing to wet weather and insufficient drainage. The drainage was improved and the area was re-sown in June, 1926 and *Crotalaria striata* was replaced by *C. anagyroides,* which had proved to be more satisfactory.

In deciding upon these main trials the advantages of the comparative level surface of slimed land for padi cultivation was borne in mind and the experiments were laid down with the definite object of planting padi on the area after the green dressings had been left to grow for three or four years. The site at Kamunting was selected because it appeared that suitable water for irrigation purposes could be obtained when required. The possibility of dredging stanniferous padi areas and leaving them more suitable for this crop on account of improvement in levels also received consideration.

Mimosa invisa was not included in this experiment because it was thought that it might be costly to remove when the land was cleared and also might prove troublesome as an "escape", since seeds are spread readily by various agencies.

Observations on this plant in the small scale plots indicated, however, that *M. invisa* would probably prove the most satisfactory plant of any tried. It died down for a short period in dry weather, but regenerated itself successively in a very satisfactory manner, adding an appreciable layer of decayed vegetable matter to the soil on each occasion. Accordingly, in December 1926 an extension of 2½ acres was added to the 4 acres and on this extension *M. invisa* was sown in clumps at 6 feet x 6 feet.

Observations on Green Dressings used in the Main Experiments.

In all cases, seed was sown in clumps in hand cultivated spots, the land between not being cultivated. Weeding was carried out in the early stages and thereafter the plants received no further attention.

The following brief observations indicate the behavior of the plants ;—

(a) *Mimosa invisa.* The $2\frac{1}{2}$ acres on which this plant was grown included the preliminary small scale trials area; the original plants of *T. candida* that still existed were allowed to remain. In six months the Mimosa had made good growth and had already begun to spread over the area. The plant behaved as in the preliminary trials and left a fresh layer of decaying vegetable matter on the land on each occasion it died down. A strong growth of "lalang" grass appeared in places where the crop died down, but the fresh seedlings soon smothered this on the return of wet weather. No difficulty was experienced in turning this crop under when the area was being prepared for the reception of padi.

(b) *Tephrosia candida.* This plant was somewhat slow in becoming established but thereafter made steady growth, the continuous leaf fall and periodic prunings providing an appreciable addition of vegetable matter to the soil. This plant, on account of its thick woody main stem, proved costly to uproot when the area was cleared for padi.

(c) *Crotalaria usaremoensis.* This plant suffered severely from wilt and within a year most of the plants had succumbed to this disease. Thereafter only a few self-sown plants remained and the land became covered with indigenous plants, including "lalang" grass, all of which made strong growth, apparently as the result of the combined effects of the green dressing and improved drainage. *C. usaremoensis* did not suffer from wilt disease in the preliminary trials probably due to the fact that the area was more closely drained than the area occupied by the main experiments.

(d) *C. anagyroides.* This plant is very quick-growing and is taller and more robust than *C. usaremoensis.* It did not suffer from wilt and succeeded in regenerating itself to some extent so that clumps of the plant still existed when the area was cleared for padi. The indigenous vegetation grew very luxuriantly after the first sown plants of *C. anagyroides* had died.

Padi Trials.

Experiments with padi were commenced on the $6\frac{1}{2}$ acres in the 1930—31 season. An encircling bund was constructed and four cross bunds made, dividing the area into four separate acres and a $2\frac{1}{2}$ acre area. Each of the separate acres contained one plot of each of the three green dressings and one control plot.

The plants of *Tephrosia candida* and *Crotalaria anagyroides* were first uprooted and the hard wood disposed of at a cost of \$17.50 per acre.

In February 1930 the whole area was cleared and all hard wood plants uprooted and removed at a cost of \$16 per acre. This was followed by cultivation to a depth of 8 inches in April at a cost of \$35 per acre which included filling in all drains and levelling up depressions. At the same time the banks of the

drain running along one side of the area were strengthered in order that it might serve as an irrigation canal and this was connected up by another canal to the source of water supply.

Initial difficulty was experienced in the efficient irrigation of the area as the slimes did not retain the water which tended to seep though to the under layer of silt. This was to some extent improved by puddling with the native hexagonal roller known as the "golek".

Four pedigree varieties of padi were sown, viz. Seraup Nos. 1, 36 and 52 and Radin 2 and in addition a little of the variety Serendah was used for a high level area on the 2½ acre section.

Sowing and planting dates were as follows:—

Variety.	Sown.	Planted.
Seraup 1.	29.7.30	20. 9.30
Seraup 36.	29.7.30	3.10.30
Seraup 52.	29.7.30	10.10.30
Radin 2.	4.9.30	13.10.30
Serendah 741.	18.9.30	23.10.30

Seraup 1 Radin 2 and Serendah were planted direct from the nurseries. Dry weather in September made it difficult to irrigate efficiently much more than one acre, so after the planting of Seraup 1, the other two Seraup varieties were transplanted in clumps near the nursery area and these were later split up for the final transplanting.

Preparation of the land was rendered difficult owing to dry weather and consequent inefficient irrigation immediately after "menajak", (cutting down of weeds) which not only delayed the rotting of the vegetation, but also allowed weeds to become re-established. A grass locally known as "Sarang Buaya" (*Ischaemum timorense*, Kunth.) proved a particularly troublesome weed through the entire first half of the season.

All padi plants made healthy growth and tillered freely and, except for persistent damage by *Nymphula depunctalis* throughout the season to plants on the outskirts of most plots, the experiment appeared to be very promising until mid-January when the presence of an unusual number of dead leaves was noticed. Examination revealed stem borer infection in 37 per cent. of the tillers.

When fruiting spikes began to appear in February it was noted that they were produced very irregularly and hopes of a good crop were abandoned.

Harvesting was commenced on March 17th. and completed on the 28th. Notwithstanding all efforts of prevention, birds which congregated in the plots in thousands, caused considerable loss of grain.

A plot of 1/40 acre was measured on the most promising area on each of the four one-acre blocks and the yields calculated therefrom were as follows:—

Seraup 1.	225 gantangs per acre
Seraup 36.	135 gantangs per acre
Seraup 52.	116 gantangs per acre
Radin	134 gantangs per acre

These measurements were not intended to serve for calculation of the all-over yield obtained, but to indicate the yield obtained on the best parts of each block where the padi had suffered least from stem borers and birds. The total padi reaped from each of the 4 one-acre blocks was:—Seraup 1, 120 gantangs; Seraup 36, 44 gantangs; Seraup 52, 52 gantangs; Radin 2, 43 gantangs.

Immediately after harvest stem borer counts were again made with the following results:—

Plants.	Tillers.	Attacked tillers.	Percentage of attack.	Caterpillars Found Schoenobius.	Diatraea.
37	1023	104	18.3	53	26

Tiller counts gave the following average for each variety:—Seraup 1, 13.4 tillers; Seraup 36, 13.4 tillers; Seraup 52, 17.3 tillers; Radin 2, 14.3 tillers.

It was found that the 2½ acres contained greater irregularity in levels than was anticipated. After harvest three more bunds were made in this area and the irrigation channel was improved and 15 small water gates were put in. It is considered that it should be possible to irrigate every part of the 6½ acres efficiently next season.

Conclusions.

These experiments have conclusively proved that padi will make very good growth on dredged land covered with from 18 inches to 2 feet of slimes if the deficiency of humus in the slimes has been to some extent replenished by means of suitable green dressings grown on the land for three or four years.

It is not yet conclusively proved that land so treated will produce heavy crops of padi, but there were decided indications that the failure to produce a good crop on Kamunting last year was entirely due to the damage done by pests, mainly stem borers. There is not sufficient data available to make an absolute statement that such is the case, but the following facts make it appear extremely probable that, but for pest and bird damage, a good crop would have been harvested. These facts are:—

(a) Healthy growth was made for the first three months after planting.

(b) The plants tillered freely and naturally.

(c) Counts proved that there was heavy stem borer infection in January—37½ per cent.

(d) Examination of 37 plants containing 1,023 tillers immediately after harvest* gave a total of 79 caterpillars in the 37 plants which is an average of more than 2 caterpillars to each plant. Of these, 53 were *Schenobius incertellus* and 26 *Diatraea auricillia*.

(e) Birds ate a considerable quantity of the ripened grain.

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* Ears only were removed at harvest, the straw being left standing.

It should be stated, further, that heavy damage by birds and insect pests was not unexpected. Isolated small areas of padi are always severely attacked by birds as is also the case in large areas when a small portion ripens before the rest of the surrounding crop. The 6½ acres comprising the experimental area is surrounded by grass land which contains many plants that have been proved to be natural hosts of stem borers as well as of other padi pests. *Nymphula depunctalis* was definitely found to be constantly brought into the plot in the irrigation water and large numbers of the insect were found on grasses growing on the banks of the main water channel from which the irrigation supply for the plot is obtained. On two occasions heavy swarms of *Scotinophara coarctata* (a common pentatimid bug pest of padi, locally called, "Bena Kura" or Kutu Bruang") settled on the crop, but hand-picking and the maintenance of a sufficient supply of irrigation water prevented this pest from becoming established. As intimated earlier in this article, the same success did not attend efforts to control *Nymphula depunctalis.*

Notwithstanding the above, it cannot yet be definitely claimed that the poor production of grain was not to some extent due to the influence of the soil. This point can only be conclusively settled by further experiments.

THE HARVESTING OF COCONUTS FOR COPRA PRODUCTION IN MALAYA.

BY

F. C. COOKE,

Assistant Chemist for Copra Research.

Introduction.

All coconut planters will agree on the importance of obtaining the greatest possible yield of copra per acre of coconuts. In this paper, while the factor of copra yield has received attention, the question of oil yield also has been given prominence, since it must be remembered that the copra which yields the highest percentage of free oil on milling is now receiving the highest price from buyers in Europe.

Various reasons have from time to time been advanced to explain the difference in the percentage oil content of copra from different sources, and in the following an attempt is made to determine the effect of nut ripeness on oil content.

Hitherto the question of correct nut harvesting has received insufficient attention, work having been confined to the study of a limited number of nuts from individual palms with a consequent considerable margin of error. Further, published opinions on the subject of correct harvesting are distinctly contrary.

Unquestionably, circumstances very much govern local practice. Thus in Ceylon, where nut storage is universally practised, it is probably advisable to collect the nuts slightly under-ripe to prevent germination in storage (1). In the Malayan small-holdings a number of other reasons may be advanced to explain unripe nut collection. Thus, the land may be leased for nut collection, in which case the collector gathers every nut visible; or it may be necessary to collect the nuts early in order to anticipate theft; or the rank state of the undergrowth may make it essential to pick all nuts and on no account to allow them to fall naturally and be lost; or finally, there is the problem of nuts which lodge in the branches of the palm and of the type which sprout while still on the stalk. These factors are undoubtedly obstacles in the way of careful nut harvesting, involving the collection of only completely ripe brown nuts, preferably by natural nut fall (2) which is actually practised in Samoa, (3) and on two estates in this country.

The frequency of nut picking tours is also an important consideration, because if they are too frequent, although the germination of fallen nuts is kept to a minimum, there will be a strong tendency to include a high percentage of unripe nuts in the crop. In small-holdings practice, nut collection is generally weekly, while on estates it is carried out either once a month, every six weeks, or every two months. The usual period in Malaya is six weeks and in Ceylon two months (4) (5).

Method of Procedure.

For this investigation, two estates were selected in each of the three main coconut producing districts of this country, and the mixed crop as normally harvested and received at the kiln was graded into a range of ripeness, consisting of eight groups arbitrarily chosen. The table and illustration which accompany this article demonstrate the method of sorting which is based first on colour of husk, and secondly on diameter of haustorium (embryo) if developed in the nut. On each of the six estates the procedure was to prepare and to examine the copra obtained from 100 nuts of each of the eight classes of ripeness so that 800 nuts were examined on each estate, or a total of 4,800 nuts. The detailed results, which have been condensed and summarised in the accompanying table, were examined statistically and although some constant variations in comparative yields were naturally obtained for the same class of ripeness, when the figures for each estate were compared, the accumulated results are sufficiently significant to justify certain conclusions.

It is admitted that this nut classification, although simple, cannot be used in estate practice. Its purpose is purely experimental, so that the necessary data having been obtained, practical nut grading can be simplified to the abstract expressions under-ripe, ripe and over-ripe.

Consideration of Experimental Results.

Copra Yield (Column 5). It will be seen by reference to the accompanying Table that the yield of "dry" copra per nut steadily increased from Group 1 to Group 5, after which it gradually declined on account of embryo development. For the purpose, therefore, of obtaining maximum copra yields, harvested nuts should contain an haustorium or "apple", about one inch in diameter; such nuts contain 19 per cent. more copra than the nuts of Group 1.

In the case of very immature nuts (Group 0), large numbers of which are collected on small-holdings, it may be estimated that less than two-thirds of the optimum weight of copra is obtained per nut. It was impossible to collect sufficient of these nuts on estates, while small-holding conditions also did not permit of the organisation of experiments, so that the probable copra yield for Group 0 had to be extrapolated roughly from the figures actually recorded.

Although it is not the intention in this paper to compare average copra yields for nuts in a similar condition of ripeness on the different estates, it is interesting to note that, whereas on one estate 100 nuts in group 5 gave 63 lbs. of dry copra, on another only 43 lbs. of copra were obtained from 100 nuts in the same group.

On one estate, the yield of copra from Group 1 was exceptionally small, only 34½ lbs. being obtained per 100 nuts. Here also ripening to maximum yield was unusually prolonged to Group 6 which produced, however, the normal yield of 50 lbs. of copra per 100 nuts, i.e. 40 per cent. more copra than for Group 1.

Coconut Harvesting in Malaya.

Group No.	Classification of Nuts.		Diameter of "Apple"	Percentage oil in derived copra. (dry basis.)	Yield per 100 nuts		Number of nuts to one picul of copra. (6 per cent. of moisture)	Census of nut collection on estates. (per 100 nuts)	Percentage Under-ripe, ripe and over-ripe	
	Description of Husk.	Description of Nut.			Dry copra (lbs.)	Oil (lbs.)			5,000 nuts from estates	20,000 nuts from small-holdings
0	Green (wholly)	Immature White Shell	Nil.	—	(38)	(25.5)	(322)	—		
1	Green (wholly)	Hard light coloured shell	Nil.	65.7	43	28.2	292	6	25 per cent. under-ripe	63 per cent. under-ripe
2	Green (partially)	Hard yellow-red shell	Nil.	64.4	47	30.2	267	19		
3	Red brown	Hard red-brown shell	Nil.	63.9	49	31.3	256	32		
4	Brown	Hard brown shell	¼"	64.0	51	32.6	245	18	70 per cent. ripe	31 per cent. ripe
5	Brown	Hard brown shell	¼" to 1"	64.4	51	32.8	246	12		
6	Brown	Hard brown shell	1" to 2"	65.8	50	32.9	251	8		
7	Brown (sprouting)	Hard brown shell	2" to 4"	67.0	48	32.1	261	4	5 per cent. over-ripe	6 per cent. over-ripe
8	Brown (sprouting)	Hard brown shell	4" and over	71.2	43	30.6	292	1		

(The bracketed figures were obtained by extrapolation). One picul—133.3 lbs.

Percentage Oil Content. (Column 6) It has already been stated that the main object of this work was to explore the subject of nut ripeness with a view to increasing the percentage oil content of Malayan copra by improved nut harvesting. Analyses gave, however, most unexpected results and emphatically demonstrated that ripeness is not a factor materially affecting the percentage of oil in commercial copra.

It will be seen by reference to column 5 that although the percentage oil content steadily increases from Group 3 to Group 8, the copra from unripe nuts (Groups 1 and 2) is suprisingly high in oil. A simple calculation will demonstrate that if unripe nuts were no longer collected and if nut collection was confined only to Groups 3 to 6, the percentage oil content of the copra derived would only show a fractional increase over previous figures.

Work at present in progress points to the possibility that the solids other than fat in coconut meat are liable to slow decomposition, even without burning taking place, on the kiln during the process of drying copra, and that this instability is greatest in the case of the immature tissue of green nuts, so that in certain circumstances it is possible to increase artificially the percentage oil content by reducing the weight of solids other than fat in the copra. This involves naturally a reduction in the effective yield of copra and explains also the anomalous figure for the percentage oil content of Group 1.

The rapidly increasing percentage oil content when germination becomes advanced (Groups 7 & 8) is caused by the removal of the inner tissue of the white endosperm as the haustorium develops. An oil gradient (6) exists in the white meat and the removal of the inner surface layers containing a low percentage of oil, by bacterial or mould action, insect attack or haustorium development leaves a residue of meat which is richer in oil than was the original uncorroded meat.

On the basis of the analytical results and the census of estate collection, it may be calculated that the fresh copra produced during these experiments would give an average oil content of 64.5 per cent. This is somwehat lower than the figure for the first quality commercial product which normally yields between 65 and 66 per cent. of oil (7). The oil gradient to be found in copra probably offers an explanation of this low figure since slight tissue removal, effected in the case of the commercial product by the formation of a superficial film of mould which is produced even on dry copra, and which subsequently readily falls off as dust, would increase artificially the percentage oil content slightly above the figure for fresh copra.

Oil Yield. (Column 7) The oil yield per 100 nuts is obtained by multiplying the figures in columns 5 and 6. It is significant that, in spite of the anomalous and high percentage oil content exhibited by Group 1, the total oil development within the nuts is a steadily increasing factor from Group 1 to Group 6. If it were desired to obtain the highest oil yield per acre, nuts should be collected containing an haustorium not less than 1 inch and not exceeding 2 inches in diameter (Group 6).

STAGES IN THE RIPENING AND GERMINATION OF THE COCONUT.

(*Reading left to right*)

Top middle : uselessly immature.
Bottom row : overgerminated.
Middle row : Nos. 2—3 : highest average copra yield per nut.
Nos. 3—4 : highest average oil yield per nut.

Nut Census. (Column 8) The nuts received at estate collecting depots were counted and a census was prepared on the same basis as the classification for the experimental work. The Agricultural Field Officers in coconut-producing districts were also asked to send in returns of nut collection on small-holdings in their sub-districts using a simpler classification as follows :—

Unripe—Green Nuts showing the least trace of green colour.

Ripe—Fully brown but unsprouted nuts.

Over-ripe—Brown Nuts with a sprout showing through the husk.

All these returns are expressed in the Table as a percentage of the total crops examined.

It will be seen that a little improvement is possible in estate nut collection while in the small-holdings an exceedingly large number of very unripe nuts (8) are included in the crop . The latter include many immature nuts which were not even allowed for in the original experimental classification (Group 0).

Loss of Copra by existing Methods of Harvesting.

An approximate idea of the average loss sustained by existing methods of harvesting may be obtained by combining the results of the nut census (Column 5) with the figures of the average copra yield per nut (Column 8), thus :—

A. *Under ideal conditions of harvesting.*

100 Ripe Brown nuts @ 0.5 lbs. dry copra per nut = 50 lbs. Yield.

B. *Estate Harvesting.*

	Nuts.		Dry copra per nut.		Yield lbs.
Unripe	6	@	0.43 lbs.	=	2.58
	19	@	0.47 lbs.	=	8.93
Ripe	32	@	0.49 lbs.	=	15.68
	18	@	0.51 lbs.	=	9.17
	12	@	0.51 lbs.	=	6.12
	8	@	0.50 lbs.	=	4.00
Overripe	4	@	0.48 lbs.	=	1.92
	1	@	0.43 lbs.	=	.43
	100	nuts yield			48.83 lbs.
Theoretical Loss					2.4 per cent.

C. *Native nut collection.*

	Nuts.		Dry copra per nut.		Yield lbs.
Unripe	63	@	0.43 lbs.	=	27.09
Ripe	31	@	0.50 lbs.	=	15.50
Overripe	6	@	0.47 lbs.	=	2.82
	100	nuts yield			45.41 lbs.
Theoretical Loss					9.2 per cent.

Thus a 1,000 acre estate producing 9 piculs of copra per acre per annum might be made to yield 9.22 piculs per acre under ideal conditions of nut collection. The extra copra produced, amounting to 220 piculs per annum, would be worth at $6.00 per picul, about $1,000 nett after allowing for the cost of extra bags, additional local transport and certain general charges.

Assuming therefore that perfect nut collection may be obtained by less frequent tours on coconut areas which are clean weeded or in low grass cover, then with the consequent increased natural nut fall, picking is also reduced to a bare minimum, the cost of nut collection should tend to be lessened and the additional profit obtainable should therefore amount at least to the $1,000 per annum stated above.

Copra Drying. The advantage of more uniform nut collection does not end with financial considerations. The indiscriminate mixing on a kiln of pieces of unripe coconut meat, containing over 60 per cent. of moisture, with ripe pieces containing 50 per cent. of moisture and over-ripe pieces with 40 per cent. of moisture or less, must result in an irregularly dried product. The under-ripe pieces are more liable to subsequent mould growth, development of a red slime during copra preparation and attack by beetles (*Carpophilus* spp.), while the over-ripe pieces can easily be over-dried and are inclined to burn.

Furthermore the copra obtainable from less ripe nuts invariably produces misshapen, testaless and wrinkled copra, while rounder, crisper and whiter copra is obtainable from ripe brown nuts.

Conclusions.

1. Ripe Malayan coconuts average 0.5 lbs. of dry copra per nut.

2. The highest yield of oil and copra is obtained in Malaya approximately at the time of natural nut fall.

3. The best nuts to collect are those which are fully brown, show no growing shoot through the husk, but when opened expose an "apple" between ¼ inch and 1 inch in diameter. This is the usual condition at natural nut fall.

4. The collection of ripe brown nuts only would result in improved yields amounting on the average estate to 2 per cent , on the average small-holdings to 9 per cent., and on bad small-holdings to 12 per cent.

5 It is not possible to improve the oil content of Malayan copra materially by more careful attention to nut collection.

6. The quality of Malayan copra woud improve if unripe and overripe nuts were excluded.

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THE REMOVAL OF PLANT NUTRIENTS IN OIL PALM CULTIVATION.

BY

C. D. V. GEORGI,

Ag. Agricultural Chemist.

Introductory.

An investigation has been carried out recently regarding the composition from the point of view of nutrients of the plant material—leaves, male inflorescences and bunches of fruit—removed from oil palms under cultivation.

Collection and Analysis of Samples.

Samples of leaves, male inflorescences and bunches of fruits, which were being removed in accordance with estate practice, were collected from different estates, the particular constituent of the palm being separated into its component parts for analysis. The proportions of the components were also determined so as to enable the composition of the original constituent to be calculated, since direct sampling was impossible.

The following table shows the details of separation in each case :—

Palm Constituent.	*Components.*
Leaf	Petiole, Leaflet.
Male Inflorescence	Stem, Finger.
Fruit Bunch	Stem, Branches. Pericarp, Shell. Kernel.

As regards the analysis of the components determinations of moisture, nitrogen, phosphate and potash were made, the methods employed being based on those laid down in the Official Methods of Analysis prescribed by the British Fertilisers and Feeding Stuffs Act of 1926.

Results of Analysis.

The results of analysis of the various components and the calculated composition of the constituents of the palms are shown in Tables I, II and III. In order to make the Tables as concise as possible only the average, maximum and minimum figures are given.

In this connection it may be mentioned that the results are based on the analysis of 11 samples of leaves, 10 samples of male inflorescences and 7 samples of fruit bunches. All the material was obtained from palms between 6 and 9 years old.

In the case of the fruit well-developed bunches were selected so that the results for this constituent may be regarded as slightly above the average, since it is well-known that with young palms some of the bunches do not contain such a high proportion of fruit as those from more mature palms.

Interpretation of Results.

In order to utilise the figures given and to form some idea of the total amount of plant nutrients removed during the course of a year it is necessary to know the weights of the fresh constituents for that period. These will naturally vary considerably, being dependent, for example, on the planting distance, the age of the palms, estate practice in pruning leaves, yield of fruit.

Although no figures can be laid down, an example, based partly on records from the Experimental Plantation Serdang, has been worked out in order to afford an idea of the total amount of plant nutrients in question.

Age of palms	6—7 years old
Number per acre	56
Leaves.	
Number removed during year	30
Average weight	11 lbs.
Male Inflorescences.	
Number formed during year	10
Average weight	4 lbs.
Fruit Bunches.	
Weight harvested during year	7300 lbs.

In the case of the fruit bunches the figure has been calculated to the amount of fully developed bunches corresponding to 4000 lbs. of fresh fruit.

Combining the above amounts of fresh constituents with the results of their analysis given previously the limits of the amounts of plant nutrients removed during the year would be as shown in Table IV.

The above figures indicate therefore that for even young palms considerable amounts of plant nutrients are removed annually in the course of estate practice.

As regards palms in full bearing it is difficult to compute the corresponding amounts, since owing to the comparatively recent introduction of the oil palm as an estate crop no records exist for the weights of leaves and male inflorescences removed annually from such palms. Allowing, however, merely for the

TABLE I.

Analysis of Component Parts and Calculated Composition of Whole Leaves.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Petiole.	Nitrogen	0.089	0.100	0.076
Proportion of leaf 73.7 per cent.	Phosphate as P_2O_5	0.022	0.038	0.017
Average moisture content 70.2 per cent.	Potash as K_2O	0.209	0.377	0.070
Leaflet.	Nitrogen	0.937	0.999	0.845
Proportion of leaf 26.3 per cent.	Phosphate as P_2O_5	0.120	0.146	0.106
Average moisture content 51.4 per cent.	Potash as K_2O	0.387	0.605	0.195
Whole Leaf. (calculated)	Nitrogen	0.312	0.336	0.278
Average moisture content	Phosphate as P_2O_5	0.048	0.066	0.040
65.5 per cent.	Potash as K_2O	0.255	0.437	0.103

TABLE II.

Analysis of Component Parts and Calculated Composition of Male Inflorescences.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Stem.	Nitrogen	0.163	0.230	0.118
Proportion of Inflorescence 17.1 per cent.	Phosphate as P_2O_5	0.034	0.040	0.026
Average moisture content 80.1 per cent.	Potash as K_2O	0.761	1.139	0.621
Finger.	Nitrogen	0.658	0.746	0.583
Proportion of Inflorescence 82.9 per cent.	Phosphate as P_2O_5	0.204	0.256	0.167
Average moisture content 70.4 per cent.	Potash as K_2O	0.583	0.700	0.333
Inflorescence. (calculated)	Nitrogen	0.573	0.658	0.503
Average moisture content 72.1 per cent.	Phosphate as P_2O_5	0.175	0.219	0.143
	Potash as K_2O	0.613	0.775	0.382

TABLE III.

Analysis of Component Parts and Calculated Composition of Fruit Bunches.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Stem.	Nitrogen	0.171	0.294	0.131
Proportion of bunch 36.0 per cent.	Phosphate as P_2O_5	0.063	0.094	0.052
Average moisture content 80.0 per cent.	Potash as K_2O	1.340	1.531	0.699
Branches.	Nitrogen	0.314	0.447	0.266
Proportion of bunch 9.0 per cent.	Phosphate as P_2O_5	0.099	0.158	0.072
Average moisture content 64.0 per cent.	Potash as K_2O	0.881	1.246	0.480
Pericarp.	Nitrogen	0.260	0.403	0.208
Proportion of bunch 33.0 per cent.	Phosphate as P_2O_5	0.094	0.113	0.066
Average moisture content 38.0 per cent.	Potash as K O	0.286	0.377	0.217
Shells.				
	Nitrogen	0.266	0.320	0.249
Proportion of bunch 17.6 per cent.	Phosphate as P_2O_5	0.045	0.059	0.028
Average moisture content 15.0 per cent.	Potash as K_2O	0.108	0.156	0.059
Kernels.	Nitrogen	0.918	1.186	0.725
Proportion of bunch 4.4 per cent.	Phosphate as P_2O_5	0.617	0.728	0.506
Average moisture content 27.0 per cent.	Potash as K_2O	0.377	0.448	0.332
Fruit Bunch. (calculated)	Nitrogen	0.263	0.388	0.215
Average moisture content	Phosphate as P_2O_5	0.098	0.128	0.074
51.2 per cent.	Potash as K_2O	0.692	0.835	0.391

estimated increase in the annual yield of bunches to 13,500 lbs. per acre it can be calculated that the average amounts of plant nutrients removed annually per acre in the case of mature palms cannot be less than 107 lbs. of nitrogen, 26 lbs. of phosphate and 154 lbs. of potash.

TABLE IV.

Limits of Amounts of Plant Nutrients Removed per Acre per Annum.

(Palms 6—7 years old and planted 56 per acre).

Details	Nutrient	Average lbs.	Maximum lbs.	Minimum lbs.
Leaves.	Nitrogen	58	62	51
	Phosphate as P_2O_5	9	12	7
	Potash as K_2O	47	81	19
Male Inflorescences.	Nitrogen	13	15	11
	Phosphate as P_2O_5	4	5	3
	Potash as K_2O	14	17	9
Fruit Bunches.	Nitrogen	19	28	16
	Phosphate as P_2O_5	7	9	5
	Potash as K_2O	51	61	29
Total.	Nitrogen	90	105	78
	Phosphate as P_2O_5	20	26	15
	Potash as K_2O	112	159	57

Remarks and Conclusions.

With such relatively large amounts of plant nutrients involved the necessity of returning to the soil as large a proportion as possible of the actual constituents will be realised,

In the case of the leaves and male inflorescences this is achieved to some extent by laying the leaves and inflorescences between the palms and allowing them to decompose gradually, the material in some instances being turned into the soil. Although this practice undoubtedly results in a certain proportion of the phosphate and potash becoming available again for the palm it is probable that most of the nitrogen will be lost.

A similar practice may be followed in the case of the debris from the fruit bunches, the material being either returned from the collecting sheds, if the fruit is separated in the field, or from the factory, if the method of bunch sterilisation has been adopted.

Further as regards the actual fruit, the ashes from the boiler, under which it is customary to burn pericarp residue, shells and, in some cases, bunch residue may be utilised for the sake of their phosphate and potash contents by spreading the material over the ground.

Even, however, if all these measures are adopted it appears likely that the application of artificial fertilisers will be necessary if the palms are to be maintained in a healthy condition, since it is uncertain to what extent the plant nutrients in the debris are conserved in the soil and become again available for the palms.

It should be realised, however, that manures may be applied for two purposes, either to replace nutrients which are being removed by the crop, thereby maintaining the supply in the soil at a desirable level, or to increase the amount of a nutrient which may originally have been present in the soil in too small a quantity to permit of maximum growth or yield.

Chemical analysis, whether of the soil or plant, cannot be relied upon as an accurate guide to the need for either type of manuring, especially in the latter case. In so far as chemical analysis may be applied as a rough guide high content of nutrients in the plant, if combined with a low content in the soil, might indicate the need for manures supplying those nutrients, while for the second type of manuring low content in the plant, if combined with low content in the soil, may, but not necessarily does, indicate the need for addition of nutrients. Only field manurial experiments can decide this point. In this connection attention is drawn to the experiments already initiated by this Department on certain estates and to which reference has been made in this Journal, Vol. XIX, No. 2, February, 1931.

In conclusion, the writer wishes to thank the Managers of Tennamaram Estate, Batang Berjuntai; Hopeful Estate, Batang Berjuntai; Bukit Minyak Estate, Batang Berjuntai and Elmina Estate, Sungei Buloh for their kindness in providing the necessary samples for analysis. He is also indebted to Mr. Gunn Lay Teik for carrying out the analyses of the fruit bunches.

TRANSPORT OF CARP FRY FROM CHINA.

BY

W. Birtwistle,

Officer-in-Charge, Fisheries Department, S.S. & F.M.S.

The Province of Kwangtung in China appears to produce by far the greatest amount of carp fry and although no figures are available, the industry must be of considerable magnitude. Enquiries were made by the Fisheries Department, S.S. & F.M.S. through one of its Chinese Officers visiting China, who reported that the fry are collected at a village called Siow Kheng on the Siow Kheng River in Kwangtung, west of Canton. The river at that point is reported to be a very fast-flowing stream. The season for collecting the fry is March and April and they are caught in a net—more properly a bag—made of coarse ramie, known as a 'Mangko' as they are washed downstream. The bag is secured in a part of the stream where the current is swift. The mouth facing up the stream is kept open by means of two poles and thus anything which floats down is swept into the first part 'A', i.e. the bosom of the net. The bosom tapers to a small circular outlet of about 4 inches in diameter and is bounded by a plaited rattan ring. This outlet opens into a square net 'B' made of similar material but with an open top. The upper edges of the net are kept about a foot above water by uprights fitted to each corner at the junction of the four bamboo floats which surround the net on all sides. The two forward corners of the net are furnished each with a looped rope which slips over a pole driven into the ground at each corner. The net is thus secured and at the same time can move up and down with any reasonable rise or fall in the level of the river.

The mouth of the 'Mangko' is usually secured two feet below the surface of the water and catches the helpless fry as they are washed downstream through the outlet into the square net where they find a resting place. The fry are taken out from time to time, and are placed in the store ponds after rejection of undesirable kinds of fish.

Nursery Ponds.

These ponds are approximately 18 feet long and 6 feet wide and filled to a depth of 1 foot with water which enters through a bamboo pipe at one end and empties through another bamboo pipe at the other end. The ponds are dug in rows, each being divided by a bank just wide enough for a man to walk. The most convenient and available water is used, but often a small reservoir across the inlet end of the ponds is constructed with sufficient head to maintain a constant flow of water. The water falls into a pond at a lower level and when necessary is restored to the head reservoir by the familiar linked wooden irrigation paddle.

At one time the fry buyers went to Siow Kheng and shipped the fry directly they were caught to a place called Boey Khoi, 3 miles from Swatow. The fry were placed in large tubs and shipped in lighters, towed by motor boats to Canton, thence by steamer to Boey Khoi, where the fish were put into nursery ponds and reared for shipment to Singapore, Shanghai and elsewhere. It is stated, however, that nursery ponds are now being established at Siow Kheng and direct shipments are being made from that place.

The unit of measure used in the sale of fry is a saucer-like vessel 8 inches across the top and about 1½ inches deep, and the buyer is expected to dip into the mass of fry himself. It is therefore advisable for a buyer to be fairly skilful in the use of the dipper if he wishes to make the best of the deal. The journey from Siow Kheng to Canton takes approximately three days. The fry, it is stated, have only absorbed their yolk by the time Swatow is reached and no food is therefore necessary up to this point.

On arrival at Swatow they are transferred into the hulls of lighters filled with fresh water and taken to the village of Boey Khoi. Thence they are transferred, by means of baskets lined with water-proof paper, and emptied into the store ponds where they receive their first feed, a preparation of duck's egg yolk which has been boiled hard, pounded and mixed with water to a thin consistency. This food is given six times a day, three times before noon and three times after, for 10 to 12 days. They are then put on an animal diet of entomostracans, copepods, rotifers etc., which are caught by coolies in fine tow nets in the early morning before the local ponds are disturbed. This is very tedious work and necessitates the employment of a large number of coolies. The fry remain on this food for another 10 to 15 days before being sorted for shipment. They are graded for size in a simple way, viz. by enclosing a mixed sample in an inverted bell-shaped sieve made of bamboo which allows those which are not large enough to escape, and retains the others. Thus graded, they are put into ponds to await buyers. The market closes after summer and fish which are unsold by this time are retained until the following year.

The fish whilst in the nursery ponds need a great deal of attention, the greatest danger being the overheating of the water, which may happen as a result of a sudden shower during warm weather and the consequent inflow of a considerable amount of warm surface water. These store ponds are small, about 18 by 6 feet and filled to a depth of 1 to 1½ feet with water. Consequently, a relatively slight influx of warmed water will cause an increase in temperature sufficiently high to be fatal to young fish. The only method of combatting this is to transfer the fry without delay into a pond with an area of water sufficient to be unaffected by these occasional sudden changes. This is done by driving the fry down through the bamboo outfall and allowing them to fall into a large pond in which is set a fine meshed net to receive them as they fall. There they remain until a fresh and cool supply of water has been run into the nursery pond to which they are transferred.

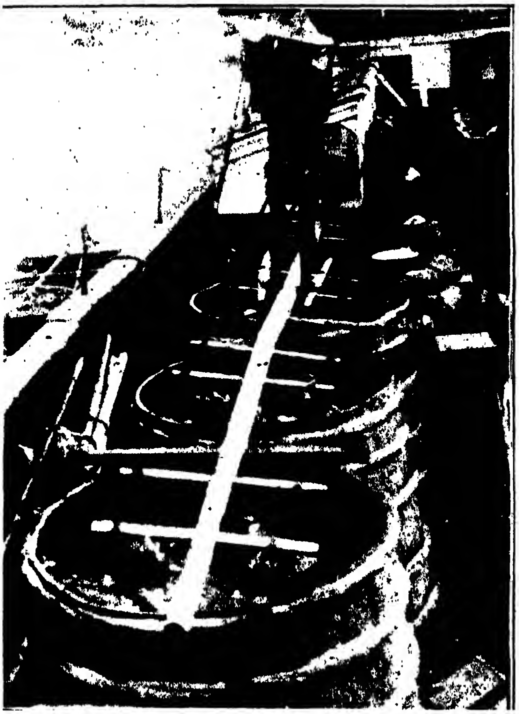
Young fry have a habit of clinging to the sides and bottom of a pond, for which reason it is extremely difficult to drive them in a given direction. To overcome this difficulty, a thick rope is dragged along the concave bottom of the pond, which, as it scrapes along, keeps the fry moving ahead of the rope as far as the outfall. Any attempt to break back over the rope can be frustrated by splashing water over the top.

The fry for Singapore are put on board at Swatow in large tubs about 6 feet high, 4 feet across the top and 5 feet at the base. They are mixed and range from 1 to 1½ inches in length and it is stated that as many as 300,000 are packed into each tub. As can be imagined the aeration of the water for such a number is not an easy task, and in fact it requires the services of four men who manage it in turns in the following way :—

The tubs are filled with water from the fry ponds and arranged in rows on the deck of the steamer. A long pole furnished with wooden cross pieces is then nailed to the centre pole and carry at each end a solid flat-faced piece of wood suspended by a cord. There are two cross pieces for each tub and therefore four pieces of suspended wood. The coolie balances himself, standing astride on the centre pole, and by shifting his weight from one foot to the other, causes the pole to rock from side to side. The suspended pieces of wood are so accurately adjusted that they will lift clear of the water when the pole is rocked in one direction but will fall with a slap on the surface of the water when rocked in the opposite direction, thus driving into the water a certain amount of air with each blow.

This rocking must continue without ceasing, day and night, sometimes for as long as 16 days. Great care must also be taken to prevent salt water finding its way into the tubs. Similarly, waste of fresh water must be avoided since ships' water is not only dear but sometimes poisonous to fish. Usually a small tub of spare pond water is carried to make up for any unavoidable losses. No food is given to the fry during the voyage since this would foul the water. Mortality is usually high and it might be said that only one half of the fish will survive a journey of about a fortnight.

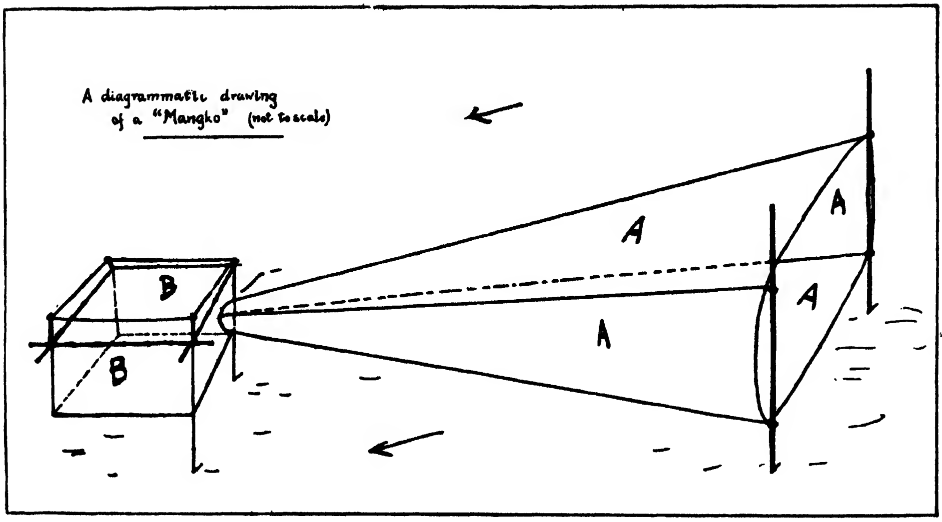
On arrival in Singapore, considerable preparations are made to receive the fish. Firstly a large lighter, carefully caulked to prevent leakage of salt water, is filled to a depth of about 1½ feet with fresh pond water and taken to the side of the steamer. The water in the tubs is carefully mixed with the new water from the lighters so that the fry may experience no great contrast of water when they are transferred in buckets and put into a coarse cloth fry net in the bottom of the lighter. They are then ferried to a waiting motor lorry and transferred to tubs for conveyance to the rearing ponds, where they will remain for three or four months before being sold. The success of these operations depends on careful handling and incessant aeration of the water. Not for one moment must this ever cease. There appears to be considerable scope for the employment of special transport cans for the fry which can be hermetically sealed and into



The rocker arrangement for aerating the water in which fry are transported from China to Singapore.

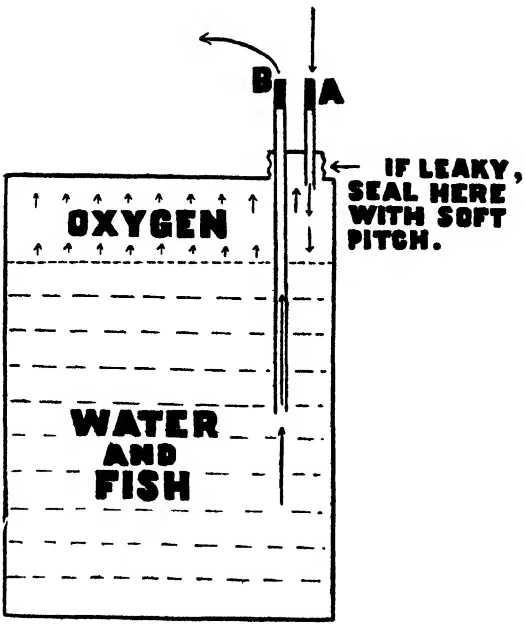
The operator is balanced and by slightly shifting his weight from side to side causes the pole to roll and lift the "droppers" out of the water one side, and to drop them on to the surface of the water on the other side. This duty must be carried on without ceasing and a stoppage would result in the total loss of all the fry.

A "CLOSE UP" OF A "DROPPER".



The "Mangko" on a bag net set to catch young carp as they are washed downstream. 'A' is the bosom of the net.

'B' is the square receiver net to hold the fry.



CONTAINER FOR TRANSPORT OF FRY.

which pure oxygen could be introduced. The employment of such receptacles for the fry would obviate the present enormous mortality and render unnecessary the considerable expense of attendants.

Experiments have shewn that 400 mixed fry 1 to 1½ inches in length can be kept for 24 hours in an ordinary 4 gallon kerosine tin with a loss of only 5 per cent. The tins should be clean and preferably new and if possible without the sealing flat which closes the outlet. The screw cap, however, must remain and be a good fit.

The screw cap is fitted with two pipes, one which reaches halfway into the tin, the other which just projects inside the tin. Each of these pipes has a length of small bore lead piping soldered to the ends which project beyond the upper part of the cap.

The tin is filled to overflowing with fish and water and oxygen is then blown through the short pipe. This displaces the water through the long pipe. Sufficient oxygen should be introduced to displace about one-fifth of the water at only a very slight pressure. The soft lead extensions should then be nipped with flat-nosed pliers to prevent the escape of oxygen, and rolled up as an extra precaution.

Care must be taken that the screw cap does not leak. It should be fitted with a soft rubber gasket. Soft pitch plastered around the outside is excellent for stopping leaks where a screw cap has been damaged or does not sit level.

Abstracts.

MALAYA AT THE PLYMOUTH GROCERS' AND BAKERS' EXHIBITION*

This exhibition was opened on March 11th, 1931 and continued until March 21st.

The Malayan Governments' Stand was devoted first and foremost to the display of Malayan canned pineapples, exhibited in a wide range of labellings and in all standard packings.

After sampling Malayan pineapples, the grocers had no hesitation in pronouncing Malayan pineapples equal in flavour, appearance and general attractiveness with the product of competing countries. The only criticisms made were (a) that too many white streaks appear, and (b) that there is sometimes a certain "woodiness" in the spiral cut slices, apparently due to the too chary removal of the core.

It was noticeable after a few days that every shop in the district was displaying Malayan pineapple prominently in its windows. A regretable feature, however, was that in some shops the so-called "G.A.Q." quality was in reality No. 2 quality.

The Exhibition was well patronised by the general public and visitors shewed quite a satisfactory interest in the Malayan fruit.

Judging by conversations with local retailers, general enquiries and the demand for booklets, it is thought that the stand performed a valuable service in the cause of general educative propaganda.

WATER-WHITE COCONUT OIL AND COCONUT FLOUR †

By cold-pressing the shredded coconut meats, which had been freed from the brown testa, a water-white oil of exceptionally high quality is obtained while a yellow oil is obtained from the parings.

The possible utilisation of the white oil cake remaining after the oil has been expelled is described. The cake was disintegrated and dried in an oven at 100°C for about 30 minutes and the crisp dry cake obtained was then ground to a coarse powder. The authors recommend that at this stage the powder should be ether extracted in order to remove as much oil as possible to prevent rancidity on keeping.‡

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* Abstract of the Report by Mr. H. S. Banner, Publicity Officer, Malayan Information Agency.

† A. O. Cruz and A. P. West. (The Philippine Journal of Science, 1930 p. 51).

‡ Nevertheless although it is known that desiccated coconut does go rancid in certain circumstances, ordinary desiccated coconut as marketed in Europe is rarely rancid, even though it may contain over 60 per cent. of oil.—F.C.C.

The redried powder is then further ground and sieved until 97 per cent. of the material passes a 20 mesh sieve. The resulting white meal when used as a flour, makes very tasty cakes, either with or without admixture of ordinary wheat flour. Furthermore, it contains about 20 per cent. of protein, a much higher proportion than is contained in wheat flour which has only about 12 per cent.

As this coconut flour makes excellent cakes and is very suitable for human consumption it is naturally more valuable than ordinary copra cake, which is merely used as cattle food.

TEA IN MALAYA.*

The estimated area planted with tea in Malaya is 1,944 acres; 701 acres of which are in Selangor, 415 acres in Pahang and 700 acres in Kedah.

Of this, 1,529 acres are estimated to be planted on lowlands and 415 acres on uplands.

In Selangor there is an appreciable area planted in tea by Chinese market gardeners. The attempt was made during the year to interest the people in improved varieties and methods of preparation.

In Kedah one large plantation of about 700 acres exists which during the year completed the erection of an up-to-date factory. Tea produced by this estate is now being sold on the local market.

Increasing interest attaches to the possibilities of cultivating upland tea in the mountainous regions in the centre of the Peninsula. Developments in this direction are being facilitated by the opening of the newly constructed road to the Cameron Highlands area in Pahang. Approximately 415 acres have already been planted in the crop and about 5,857 acres of land have been alienated mainly for this form of cultivation in these regions, while alienation of a further area of 6,080 acres has been approved. Experiments conducted by the Agricultural Department give some grounds for the belief that these regions are well adapted for the growth of the finer type of tea.

The experimental investigations both on highland and lowland tea were advanced a stage further and pluckings were made from tea areas at the Experimental Station at Cameron Highlands.

The erection of an Experimental Tea Factory at Serdang was commenced and proposals approved for the installation of tea-making machinery at Cameron Highlands.

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* Abstracted from the Annual Report of the Department of Agriculture, 1930.

Miscellaneous Article.

ENTOMOLOGICAL NOTES.

Third Quarter, 1931.

BY

G. H. CORBETT.

The white ant, *Coptotermes curvignathus* Holmgr., frequently referred to in entomological literature as *Coptotermes gestroi* Wasm., is familiar to most cultivators owing to the attention it pays to living rubber trees and has often been assumed to be the only species which will attack healthy plants in Malaya. Whilst this assumption is generally true, in so far that most species of white ants feed upon dead or unhealthy trees, it is not strictly accurate. During the past quarter, the writer observed soldiers and workers of the white ant, *Rhinotermes* (?) *malaccensis* Holmgr., at work at the base of an oil palm, which they had penetrated for a distance of about 3 inches and, although the leaves of this palm resembled the leaves of palms suffering from the so-called crown disease, the trunk appeared to be entirely sound.

The white ant, *Microtermes pallidus* Hav., has also been noticed damaging tea and coffee bushes in Malaya.

In this connection it may be of interest to relate that *Coptotermes curvignathus* frequently bores the trunk of coconut palms, but observations indicate that entrance is never effected through the base of the palm but always by way of the crown or directly through the bole. Where communication with the ground has become established, this has been accomplished from within the trunk and not through the base of the palm.

Oil Palm.

The caterpillars of a *Tirathaba* sp., which has been mentioned in previous entomological notes, were again received during the past quarter causing injury to the fruit bunches of the oil palm. This insect may be responsible for more damage than has hitherto been observed and the writer would be glad to receive oil palm bunches which appear to be harbouring caterpillars.

A note concerning the association between insects damaging copra and the use of old rice sacks appeared in entomological notes for last quarter. Therein it was stated that one of the principal means whereby copra became infested with insects was the employment of old rice sacks. It has come to the writer's notice that old rice sacks are also used for the transport of oil palm kernels and considerable damage to kernels by the caterpillars of the moth, *Ephestia cautella*, a pest of stored rice, was undoubtedly due to the presence of the larvae of this

moth in the sacks prior to being filled. It is suggested that old rice sacks before being filled with kernels should be steamed. This operation should not been expensive since steam is readily available in oil palm factories.

Padi.

The results of last season's work, 1930—1931, on the control of padi borers by *Trichogramma minuium* have been analysed and will be published in the near future. Mr. H. T. Pagden, Assistant Entomologist, who supervised the field work, reports that whereas egg-masses of *Diatraea auricilia* parasitised by *Trichogramma minutum* were collected earlier from the colonised than the uncolonised area, that a higher percentage of parasitised egg-masses were obtained from the colonised than from the uncolonised area and that the percentage of "bored" stems was less in the colonised than in the uncolonised area, the yield of padi from the colonised was less than that obtained from the uncolonised area. The uncolonised area was a considerable distance from the colonised area and it is thought that the yield from the uncolonised being greater than that from the colonised area was largely due to the soil being more fertile in the former than in the latter area. Arrangements are well advanced for further work in the control of stem borers by *Trichogramma minutum* in the forthcoming season 1931—1932 and especial attention will be devoted to obtain reliable and comparative yield results. For this purpose adjoining plots, half of which will receive parasites, have been so arranged to compensate as far as possible for drift of parasites.

In connection with this work, during December, 1930, January and up to February 5th., 1931, when liberations ceased, 33,500,000 eggs, an average of one half a million per diem, parasitised by *Trichogramma minutum*, for distribution over the experimental areas were sent to Parit Buntar from Kuala Lumpur.

During February, the Braconid parasite, *Microbracon hebetor* Say., appeared in the Insectary and so-reduced the colony of moths, viz: *Sitotroga cerealella* Ol., *Ephestia cautella* Walk. and *Corcyra cephalonica* St., the eggs of which are used for the propagation of *Trichogramma minutum*, that a new colony had to be built up. This has been established and up to the present *M. hebetor* has not re-appeared. Instead of fumigating the bran and rice with carbon bisulphide, which was considered to be unsatisfactory, steam was employed to render this mixture free from insects.

Enactments.

In the Agricultural Enactments and Rules, Federated Malay States, Schedule A., appear the names of plants, viz: rubber, cotton, sugar cane, coconut, coffee, bananas, tea, oil palm, which have to be certified by an Inspecting Officer that they are free from disease or pests before they are permitted to enter Malaya. This procedure is designed to prevent the introduction of an insect

or disease which may not be present in Malaya. Closely connected with the prevention of pests entering a country is the prevention of spread of those which have been introduced. In Malaya, two introductions, the giant snail and the coffee berry beetle borer, have occurred. The sources of these introductions are not known, but is it possible that the former came from Ceylon and the latter from Java. Although these introductions would be impossible to exterminate, they are not present in every part of Malaya and if care were exercised they could still be prevented from spreading from infected to uninfected areas.

The giant snail is undoubtedly spread by enthusiastic gardeners and agriculturists who distribute plants from one part of Malaya to another and at their destination, precautions are not taken to examine the wrappers, the soil or plant in order to ascertain if they harbour the eggs or snails. The giant snail is not present at the Government Experimental Plantation, Serdang, but would undoubtedly have been if prompt action had not been undertaken in examining all planting material on its arrival.

The coffee berry beetle borer is a serious pest, and to bring this insect under control, it has been found necessary to prevent the formation of berries over an extended period. Even if present in small numbers, this insect causes a considerable reduction in the yield of coffee beans. Coffee areas free from this beetle in Malaya are known and to prevent it gaining entrance to uninfected areas, further supplies of coffee seeds should not be introduced and, where new areas are to be planted, even if the seed has been certified as free, it is advisable to take the necessary precaution of immersing it in boiling water, in case this beetle in any of its stages be present. No alternative host to cultivated coffee is known, but several wild species of coffee occur in Malaya and eventually this beetle may be found to breed on wild coffee until such time as the cultivated coffee has produced berries.

Reviews.

Annual Report of the Department of Agriculture S.S and F.M.S. for the year 1930

31 pp. F.M.S. Government Press, Kuala Lumpur, 1931.

Brief reference was made in this Journal last month to the recently published report by Dr. H. A. Tempany, Director of Agriculture on the work of his Department during the year 1930.

The first part of the report is concerned with a survey of general agricultural conditions in Malaya during the year, and provides a review of the development of agricultural industries for this period. In this section 5 pages are devoted to rubber and give a concise statement of area, production, prices, conditions on estates and on small holdings, pests and diseases and research facilities.

It is frequently assumed that the Department of Agriculture is no longer concerned with rubber since the Rubber Research Institute of Malaya came into being. An examination of this report, however, shews that the Department is intimately concerned with the collection of statistics of areas and production, besides being responsible for all disease control work and propaganda among small holdings. The Department works in close liaison with the Rubber Research Institute, which is responsible for research work on rubber, and with the Department of Co-operation, which has undertaken work in relation to improvement of manufacturing and marketing methods among small holders.

A great deal of work was performed by the Department during 1930 in connection with the coconut industry. Some of this work, e.g. selection and cultivation experiments, has been continued for some years and important data are resulting therefrom. In addition, research on the manufacture of copra and on the causes of deterioration of copra has been carried out which may materially assist the industry in the near future. Important contributions towards our knowledge of the control of coconut pests have been made by the Entomological Division during the year.

The work of the Department on the improvement of padi varieties is well known and generally acknowledged. Work in this connection has been continued and extended by breeding investigations. The inauguration of numerous padi test plots has rendered the work of distribution of suitable strains throughout the country more effective, while research on the incidence and control of padi pests has made notable advances during the year. The control of rats in the large padi-growing areas has been continued and no less than 3,300,000 rats accounted for in the main areas of Krian and Province Wellesley. The saving of crop by these campaigns must be very considerable. The statistical work on this and other crops of importance has been reorganised and is proving a valuable factor in observing the effect of improvements attained by research and control work.

The oil palm industry has been carefully fostered by the Department. On the field side, investigations in relation to pollination, pruning, manuring, cultivation and drainage have been continued and results published from time to time, while the close investigation of the Department on the manufacturing side is recognised by the industry as is evinced by the very frequent enquiries from estates for the expert advice of the Department. The experimental oil palm factory operated by the Department is equipped to continue research on the production of improved products and on the comparison of methods of oil extraction.

The Department has continued investigation on tea production both on the lowlands and uplands of Malaya. The industry has developed and free use has been made by the public of the results obtained by the Department. The erection of tea factories at the lowland experimental area at Serdang and the upland area at Cameron Highlands respectively will enable the investigations of the Department to make considerable advances in the near future.

During the year provision was made for the inauguration of a pineapple experiment station in Singapore Island. In addition, experiments with pineapple were laid out at the Experimental Station at Serdang.

A very thorough investigation into the economic side of the industry was made during the latter half of the year. The result of this enquiry was given prominence in the last number of the *Malayan Agricultural Journal.*

In addition to the continuation of experimental work on coffee at Serdang and advisory work in connection with the pests and diseases of this crop, experiments at Cameron Highlands have shewn that Coffee Arabica can be satisfactorily grown there, and there seem to be prospects of some plantation development with this variety in that area.

Among numerous other crops which were the subject of investigation during the year may be mentioned tobacco. The Director states—

> "There seems to be no adequate reason why tobacco cultivation should not be undertaken in Malaya with fair prospects of success, with a view particularly to the reduction of imports."

The possibilities in this direction have been considered by the Department and provision for further experimental work on the crop has been made.

Attention is directed to the scope for a considerable extention in stock raising in Malaya and the work of the Department and private enterprise is summarised.

The work of the Department on the improvement of the breeds of pigs is also summarised, while it is shewn that the Department is taking practical steps to effect improvements in relation to sheep, goats and poultry.

The second part of the Director's report is concerned with a more detailed account of the activities of the Divisions of the Department. In an introductory section, attention is drawn to reorganisation proposals which comprised, ***inter alia,***

schemes for the re-grading and re-distribution of duties of both European and Asiatic staff and the enlargement and extension of the field work, including a comprehensive provision of test and experiment stations throughout the country.

The buildings of the new School of Agriculture at Serdang were completed, the curriculum of the School approved, and steps taken for the recruitment of the necessary staff.

A start was made on the programme of proposals for establishment of agricultural stations and test plots throughout the country. The scheme for operating padi test plots was re-cast and standardised lines for experiments both with new selected strains of padi seed and with manures were worked out; experiments on the cultivation of padi were also begun.

Efforts were continued to extend the distribution of planting material for minor crop and fruit trees, and it was arranged that as each agricultural station came into being, plant distribution work should comprise an integral part of the work.

The activities of the Department in relation to school gardens have been maintained and extended and a gratifying improvement in work in this direction is visible.

The publications of the Department were re-organised and met with widespread appreciation in their new form.

The Director concludes—

> "The year has witnessed a very considerable extension of the activities of the Department and it is believed that the work done is meeting with a measure of appreciation from the public which the Department is intended to serve."

D. H. G.

The Bionomics of some Malayan Rhynchota (Hemiptera-Hetiroptera).

By N. C. E. Miller, F.E.S.

Special Bulletin, Scientific Series, No. 5, Department of Agriculture, S.S. & F.M.S., 142 pages and 123 text figures, Price one dollar (Straits Currency.)

In this publication the author has contributed detailed information regarding eighteen species of Rhynchota occurring in Malaya and described two new species, *Ochrochira rubrotincta* and *Dereptcryx chinai.* Both these species were collected at Cameron Highlands (4750 ft.), the former feeding on *Citrus limonum* and the latter on *Rubus* spp.

The distribution, host plants, economic importance and notes on the life histories of all these species are given and the nymphal stages of the majority are described and illustrated. Certain external features are discussed and

methods used for rearing described. To assist the worker in the field in identifying a particular species a list of the names of plants with Malay names has been prepared. In addition, measures for the control of bugs are discussed and a bibliography of the literature cited completes the publication. The author has advanced considerably the knowledge concerning the nymphal stages of some species of Rhynchota and the publication should prove of value to entomological and agricultural workers in Malaya and elsewhere.

G. H. C.

Mineral Content of Natural Pastures.

Sixth Report of the Committee of the Economic Advisory Council.

London H. M. Stationery Office 1931 66pp. Price 1s. 0d. Net.

The Committee of Civil Research appointed a sub-committee in 1925 to consider and report on the mineral content of natural pastures. Later in that year, this sub-committee presented the first Interim Report giving the substance of the scientific results at present achieved and indicating the lines on which further information was desired. In the following year the report on a visit to South Africa and Kenya by Dr. J. S. Orr was considered from which the sub-committee decided that co-ordinated research effort in this direction was likely, within a relatively short space of time, to yield further information of practical value to the animal husbandry industry of the Empire.

The second report, which was presented in 1926, set out the facts brought out by the inquiry and recommended "that any practical investigations should be carried out in the most suitable colony or dependency with a view to ascertaining whether the nature of mineral deficiencies can be determined and the diseases due to them prevented."

The acceptance of these recommendations led to the inauguration of research work in Kenya. Dr. Orr, the Director of the Rowett Research Institute, Aberdeen, was appointed Director of the investigation and a member of the Committee.

The Report traces the progress of the investigations after the Research party took up their duties in Kenya. The details of the work are contained in subsequent reports of the Committee. The field work was completed in 1929 and an account of the whole investigation prepared by Dr. Orr in association with Mr. Alex Holm, Director of Agriculture, Kenya. This report is published in the Report under review.

A summary of the most important results is given together with the recommendations.

The mineral deficiency most generally found was sodium and to a less extent chlorine. The element which shewed the largest deficiency in certain cases was phosphorus.

The application of different fertilisers to the pastures in the most deficient area increased the yield of pasture from 25 per cent. where common salt was used to 400 per cent. when nitrogen and phosphates were used. Grazing animals shewed a marked preference for the parts which had been treated with fertilisers.

In districts where pastures were deficient in mineral, the provision of those to grazing animals was followed by a definite increase in rate of growth, and in milk production in the case of dairy cows.

It was found that the disease "Nakuruitis" was prevented from developing if the animals were allowed access to a mixture of common salt and an iron salt. If these results are confirmed in practice they will be of considerable economic importance.

D. H. G.

Journal of the Rubber Research Institute of Malaya.

Vol. 3 No. 1 August 1931. 53 pp. Price 50 cents.

This publication contains only the results of investigations carried out by members of the staff of the Institute or articles containing the results of investigation specially contributed. All abstracts and reviews of investigations carried out in relation to rubber cultivation, preparation, diseases, etc. in other rubber producing countries will be published in the *Malayan Agricultural Journal.* The present number contains five informative articles; viz. "A bacterological study of the decomposition of soil organic matter and its bearing on the question of manuring" by Dr. A. S. Corbet; "The effect of covers and clearing methods on the growth of young rubber" by A. R. Sanderson and Dr. W. B. Haines; "Standard instructions for the protection of pruned surfaces in budding operations" by A. Sharples and C. E. T. Mann; "The Heusser system of double tapping as applied to Prang Besar clones" by R. J. Chittenden; and "Further observations on planting systems for budding of tested clones" by C. E. T. Mann.

Departmental.

FROM THE DISTRICTS

The Weather.

September is reported to have been generally wet in North Kedah but the rainfall in the south of Kedah and in Province Wellesley and along the coast of Perak and Selangor was below the normal for September. This applies especially to Penang and Province Wellesley where although the weather was cloudy, very much less rain fell than usual, although it became wetter towards the end of the month. Fairly heavy precipitation occurred on the mountain range near Taiping, but elsewhere inland in Perak the rainfall would appear to have been a little below the normal for September. In Malacca and Singapore very heavy rain fell and figures are above the September average. Negri Sembilan and parts of the inland areas of Selangor would appear to have shared in this heavier rainfall.

Remarks on crops.

Rubber.—Prices for small-holders' rubber have been slightly below those for the last month, the quotations per picul and range being, smoked sheet $6 to $10; unsmoked sheet $4 to $8; scrap $2 to $5. In these quotations the higher prices regularly paid in parts of Province Wellesley have been excluded. At Butterworth the prices per picul were, smoked sheet $8.40 to $11.60, unsmoked sheet $7.50 to $9.25, scrap $4 to $5. These higher prices have heretofore been included in the quotations given.

During the month a number of holdings were selected in Johore for the investigations in connection with bark consumption on small holdings and it is proposed to select the remainder so that the first measurements throughout that State can commence on November 1st.

The area of untapped holdings in Negri Sembilan is reported to be approximately 6,000 acres. In Province Wellesley further holdings have gone out of tapping but this is, to some extent at least, due to owners being engaged on the padi crop. In Malacca where padi planting is finished, many holdings are being brought into tapping again. The position regarding Mouldy Rot control remains as reported last month.

Padi.—Planting proceeded satisfactorily in North Kedah and throughout Perak but in South Kedah and in Penang and Province Wellesley planting continued to be further delayed from insufficient water, until towards the end of the month when wetter weather prevailed. A sufficiency of irrigation water allowed planting to be satisfactorily completed in Kuala Kangsar and Upper Perak Districts. In many parts of the inland areas of Selangor the padi is beginning to flower. This very early planting, which appears to have been habitual in Selangor of late years, is not recommended, as much loss of grain

almost invariably ensues owing to harvesting taking place in rainy weather. Cultural methods in other respects are not generally so sound as those of the planters in most other parts of Malaya. In Negri Sembilan and Malacca the planted crop is making good growth. In the Kuala Pilah District of Negri Sembilan the crop is not yet planted. In both Negri Sembilan and Malacca it is thought that the planted area will exceed that put under the crop last season.

Collapse of Krian Spillway.—It has to be reported that on September 20th nine gates of the fifty-one that form the spillway of the Bukit Merah reservoir for Krian irrigation collapsed. The result is that irrigation for the whole of the Krian irrigation area is at an end for this season and it is expected that rebuilding of the spillway, which is considered to be necessary, will take a year to complete. As planting was well forward this season, it is thought that, provided the rainfall is up to average for the next three months, the present crop may not suffer unduly. Next season's Krian crop, however, will be wholly dependent upon rainfall so that prospects are not particularly hopeful, unless rainfall for the planting and growing season should be well up to the average and fairly evenly distributed through the season.

Tobacco.—In both Kedah and Province Wellesley it would seem that production has caught up with the local demand for this product, for prices have fallen considerably. Owing to the Federated Malay States and Straits Settlements import duties, the market for locally grown leaf is practically confined to the State and Settlement respectively in which the plant is grown and product prepared. The crop continues to extend in Kuala Kangsar, Kinta, Batang Padang and Lower Perak Districts of Perak. In all cases curing methods are crude and only designed to turn out a low grade product to supply a local demand for such. In Kedah the Principal Agricultural Officer is preparing a pamphlet with a view to encouraging improved harvesting and curing methods.

The prices ruling per picul for cured leaf are :—Kedah $28/- ; Penang, first quality $35/-, second quality $30/- and third quality $20/- to $25/- ; South Perak, $50/- to $65/-. The green leaf is sold by growers in South Perak for from $9/- to $10/- a picul.

Agricultural Stations and Padi Test Plots.

Kedah.—Planting was completed on Telok Chengai Rice Station and the Test Plots at Jitra, Langgor and Sala Kanan. At Rantau Panjang cultural operations were delayed owing to water shortage.

Province Wellesley.—At Glugor Padi Station the long-season varieties of Seraup padi have been planted and the planting of the Radin varieties commenced. A start has been made on the erection of two culverts under the main road to take off flood water. At Bukit Merah Padi Station planting of the long-season Seraup varieties was commenced at the end of the month.

Perak.—(*a*) *Agricultural Stations. Selama.* The clearing up of the "lalang" grass area has been completed and a contract for felling some trees and for general levelling of the site has been let. The erection of fencing is delayed for want of survey and exact demarcation of boundaries.

Kuala Kangsar.—The local maize hybrids were harvested but only gave a light crop. A good crop of Soya beans was harvested. A Chinese variety of tobacco which promised well has suffered from slime disease. The Virginia varieties are making much less robust growth than the local varieties. A batch of cured tobacco of the Kedah variety was sent to Headquarters for examination and report. The oranges are showing renewed vigour as the result of a dressing of stable manure applied last month. Tapioca and pepper were planted. The nursery contains very healthy seedlings of rambutan and marcots of oranges designed as stocks for budding.

(*b*) *Padi Stations and Test Plots. Talang.* Planting is nearly completed on the manurial and cultivation trial areas and the Seraup strains have been planted on the deeper areas usually reserved for them. The area for the banana manurial experiments has been demarcated and cleared.

Lenggong.—Planting is completed. Following last season's practice, only one plant has been used for each hill and this practice has also been adopted for the manurial and cultivation trial areas on Talang.

Bruas.—The Seraup varieties have been planted. Water supply has been adequate and the regulation of its flow over the Plot is satisfactory.

Bukit Gantang.—The dividing bunds have been laid down and completed and plants are ready for planting, but the operation is held up to coincide with the planting of the surrounding areas.

Kamunting.—Planting of the Seraup strains was completed and planting of the Radin varieties had commenced at the end of the month.

Selinsing.—The planting is completed. With the failure of irrigation owing to the collapse of the Bukit Merah spillway, water is not so plentiful as usual but has been sufficient for requirements up to the present.

Selangor.—Cheras Agricultural Station. The whole of the higher portion has been cultivated once and eradication of "lalang" grass has made satisfactory progress. Fence erection was commenced. The erection of buildings has been postponed pending approval of the plans by the Health Department. A contract for clearing the lower area has been arranged, the Chinese squatters having decided to move to a new area before the end of the year.

Kajang Test Plot.—The variety Nachin 27 has commenced to flower, but the Radin varieties have not yet thrown up their panicles. The plants have made fair growth in spite of a shortage of water.

Kuang Test Plot.—This plot has a somewhat ragged appearance owing to the irregularity of the plants due to pest attack, stem-borer having been somewhat prevalent. The quarters for the subordinate officer in charge are ready for occupation.

Negri Sembilan.—(a) Agricultural Stations. The fruit trees on the Seremban Station received a dressing of manure. At the Rembau Station the whole area has been sown with cover crops which are germinating satisfactorily. Contracts have been let for fencing and for making the road and boundary path. Erection of buildings is proceeding rapidly.

(*b*) *Padi Test Plot.*—Flooding of the station occurred on several occasions but did little damage to the planted padi, as the water subsided quickly.

Malacca.—Sungei Udang Agricultural Station. Most of the large stumps have now been removed. Six varieties of bananas and two high yielding clones of rubber were planted. Four varieties of coffee have been sown in the nursery. Drainage of the kapok and rubber blocks is in progress.

Pulau Gadong Padi Station.—Transplanting of the short-season pedigree lines and multiplication plots was completed early in the month. A belt of land on the adjoining Crown Land was cleared as a rat protection measure. The low-lying portion of the Station was flooded on the 22nd. owing to a sudden rise of the Ayer Hitam river but no extensive damage is anticipated as the result.

Alor Gajah Test Plot.—Plants are making very satisfactory growth and the plot presents a very pleasing appearance from the main road.

Singapore.—Pineapple Station. In the manurial trials fertilisers were applied. In the cultural trial area the plants treated with "Pabco Thermogen" have noticeably made better growth than those on other plots. In the rotation and green dressing trials, difficulty has been experienced in establishing cover crops. Experiments are in hand to ascertain how best the difficulty can be surmounted. Tobacco has made fair growth on fertilised plots, but very poor growth on the unmanured plots. Varieties of coffee, bananas and arecanut have been planted.

DEPARTMENTAL NOTES.

Mouldy Rot Control.

A deputation from the Planters' Association of Malaya consisting of the Hon'ble Mr. J. S. Arter, Chairman of the Association, Mr. L. W. Tivy and Mr. W. J. Doughty called upon the Acting Director of Agriculture (Mr. F. W. South) on 12th September, 1931, to discuss the incidence and control of Mouldy Rot Disease of rubber especially on small holdings.

The deputation contended that the disease was becoming rapidly more prevalent throughout various parts of the country and that in many cases the present methods of treatment were inadequate. They also pointed out the danger of the spread of the disease to large estates by reason of infected holdings on their boundaries.

The Acting Director stated that the position was fully recognised but that the present financial position of small-holders rendered it impracticable to insist on the same standard of control as had been maintained in the past, more especially was it impossible to require cessation of tapping for several weeks, a factor of major importance in the successful treatment of the disease. The policy of the Department was to educate rather than compel the small-holder to maintain control measures in his own interest, and to induce him to continue at least such control measures as would prevent excessive damage to the renewing bark on his trees. The position had now been reached that the small-holder in many cases could not afford to purchase a suitable disinfectant in any great quantity.

It was agreed that estate managers who were willing to do so should be advised to stock an approved fungicide for sale at cost price to owners of adjoining small holdings.

It was also agreed that special steps should be taken to obtain the fullest possible co-operation from all Administrative Officers in persuading small-holders to continue periodic painting with an approved disinfectant.

Assistance from Administrative Officers has often been obtained in the past with satisfactory results.

School of Agriculture, Malaya.

Two special short courses of instruction were given at the School of Agriculture, Malaya, during the school vacation. A ten day course of instruction was given to six Malay Co-operative Officers and from 4th. to 31st. August a course was given to 4 Assistant Penghulus from Perak.

Mr. V. Dawson, Senior Lecturer and Mr. J. S. Norman, Field Instructor and Superintendent, spent a fortnight of the school vacation in a visit to Carey Island, Port Swettenham, in order to study practical planting methods. Carey Island Estate was ideal for this purpose as it is concerned with rubber, coconuts and tea, and is so organised and self-contained by reason of its position and stage of development as to provide a demonstration of great value on estate management and routine.

The Department is indebted to the General Manager and Staff of Carey Island not only for assistance in this instance, but also for the facilities which Jugra Land and Carey Ltd. has always so readily afforded for conducting field investigations on various agricultural problems.

Bull Calves for Sale.

The Department offers for sale three pure-bred Montgomery bull calves reared on the Government Stock Farm, Serdang. Montgomery cattle is a dual breed suitable for draught and dairy purposes. For particulars apply to the Senior Assistant Agriculturist, Government Experimental Plantation, Serdang, F.M.S.

Tours of the Rural Lecture Caravan.

The Rural Lecture Caravan toured the Krian District of Perak from July 3rd. to 14th. visiting eight centres. The total attendances at the lectures and demonstrations were estimated to be over 14,000 persons.

The Caravan toured the Negri Sembilan from August 5th. to 19th., 1931, visiting twelve centres at which the usual demonstrations, lectures and films attracted large and appreciative audiences, in each case drawn from a wide radius.

In September the Caravan commenced a tour in Perak, starting from Parit and working through the Upper Perak and Kuala Kangsar Districts. In all 19 lectures and demonstrations were to be given.

Leave.

Mr. V. R. Greenstreet, Assistant Agricultural Chemist, returned from leave of absence on 3rd. September, 1931.

Statistical.

MARKET PRICES.

September, 1931.

The depreciation in value of the pound sterling has resulted in considerable activity, practically all commodities advancing in price. There are already signs of an early reaction in many directions.

Rubber.—The spot price of rubber smoked sheet equal to London standard remained steady in Singapore around 7⅛ cents per lb. until the last week of the month when the price rose to 8⅝ cents per lb. falling by the end of the month to 8⅛ cents. The average Singapore price for the month was 7.6 cents per lb. as compared with 7.3 cents in August. The average London price was 2.5d per lb. as compared with 2.4d in August.

Palm Oil.—The quotation at the end of September was £17.12.6 C.I.F. October/November shipment.

Copra.—Singapore copra prices remained steady around $3.90 per picul for "Sundried", but shared in the rise at the end of the month, touching $4.80, but sagging to a price around $4.50. The average Singapore price for this grade in September was $4.04 per picul and for "Mixed" $3.72, as compared with the average for the previous month of $4.21 and $3.91 respectively.

Copra cake was quoted for the greater part of the month at $2 per picul, the average price being $1.96 per picul.

Coconut Oil.—Our Singapore correspondent states that the average wholesale export price of coconut oil was $9 per picul for September. The slight increase in copra prices has not materially improved conditions in the oil business.

Gambier.—Block gambier appreciated by 50 cents and cube No. 1 by $1 per picul. The average Singapore prices for September were $9.75 for block and $17 per picul for cube No. 1. Corresponding prices in August were $9.56 and $17.25 respectively.

Rice.—The average wholesale price of Siam No. 2 Ordinary rice per picul in Singapore in August was $4.16 as compared with $3.50 in the previous month. The retail market price in cents per gantang of No. 2 Siam rice in August was :—Singapore 30, Penang 31, Malacca 28 as compared with 30, 25 and 27 for July, 1931. (See General Rice Summary in this issue for further notes on the rice market in Siam and French Indo-China.)

Arecanuts.—Palambang Whole improved in price owing to purchases for the Hongkong market. The average Singapore price in September was $4.69 per picul as compared with $3.47 for August. Owing to small imports, Bila Whole firmed to an average of $4.16 against $3.44 for the previous month. For other grades the average prices were as follows :—Sliced (mostly bought for the Annam market) $5.44 to $17.81; Split $4.62 to $6.25; Red Whole $7.94 to $8.40;

Kelantan Split $6.44 to $6.69—all per picul, the price within each range depending upon quality.

Coffee.—There was little demand until the end of the month when the exchange with the Dutch Indies fell to 105 guilders to $100 which caused an increase in values of coffee. Average Java Robusta prices varied from $15.31 to $16.44 per picul, the price between these limits depending upon quality. Corresponding average prices for the previous month were $14.25 to $16.70 per picul. The average price of Palambang coffee in September was $11.69 per picul as compared with $11.44 in August.

Pineapples.—For the first half of the month, the demand was small and there was little disposition amongst sellers or buyers to effect sales. Later buyers were disposed to meet advancing prices and a fair turnover was done for October/December shipment. Average prices per case for September were:—1½ lb. cubes, $3.50; 1½ lb. sliced flat, $3.27; 1½ lb. sliced tall, $3.31 as compared with $3.44, $3.28 and $3.39 respectively in August.

Tapioca.—Prices were steady until the latter part of the month, when there was a sharp rise in all grades. Average Singapore prices per picul for September were:—Flake fair, $3.41; Pearl seed, $4.47; Pearl medium, $4.49, as compared with $3.32, $4.19 and $4.42 respectively in August.

Sago.—During the first half of the month the market was dull and neglected, but later prices advanced so sharply that an early reaction is not unlikely. Pearl—Small fair averaged $4.44 for the month, compared with $4.25 per picul in August while Flour—Sarawak fair, averaged $1.82 per picul as compared with $1.75 in August.

Nutmegs and Mace.—Quotations are all marked up to nominal prices although the volume of business passing is small. Nutmegs, 110 per lb. average $20.87 per picul throughout August and September, though the nominal price towards the end of September was $24 per picul: 80's averaged $28.75 per picul in September, the nominal price latterly being $34. The average price for this grade in August was $27.37 per picul.

Siouw mace averaged $64.25 per picul in September and Amboina $44.75. August average quotations were $56.50 and $38.75 respectively.

Pepper.—The price of all grades of pepper appreciated sharply, buyers holding off at the latest prices quoted. Average Singapore prices per picul in September were:—Singapore Black $19.09; Singapore White $28.56; Muntok White $29.44. Corresponding prices in August were $18.19, $27.25 and $28.37 respectively.

Cloves.—Zanzibar cloves are quoted nominally at $50 per picul and Amboina at $60 per picul. Average prices for September are Zanzibar $44.75 and Amboina $51 per picul.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in September and on other local sources of information. Palm Oil Reports are kindly supplied

by Messrs. Lewis and Peat (Singapore) Ltd.; reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore, and a report on the coconut oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs. The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

MALAYAN AGRICULTURAL EXPORTS.

First Half Year 1930 and 1931.

Product	Net Exports in Tons				
	1930	Jan. 1—July 31, 1930	Jan. 1—July 31, 1931	July 1930	July 1931
Coconut, fresh	10,478	6,051	4,721	1,085	918
Copra	102,014	46,530	47,042	6,436	5,916
Coconut oil	9,473	5,668	5,939	676	982
Palm oil	3,211	1,594	2,033	264	208
Palm Kernels	485	235	301	30	19
Pineapple, canned	57,698	39,423	41,029	5,957	6,196
Tapioca	31,195	17,944	17,272	2,325	2,863
Arecanuts	23,254	15,386	12,595	863	1,348
Tuba root	55½	—	41	3	8½

GENERAL RICE SUMMARY. *

August 1931.

Malaya.—Reports indicate that padi planting work for the new season 1931—2 is in hand in all areas.

Total foreign imports of rice into Malaya for August amounted to 67,862 tons, of which 48 per cent. went to Singapore, 24 per cent. into Penang, 8 per cent. into Malacca, 17 per cent. into the Federated Malay States and 3 per cent. into the Unfederated Malay States.

Of these imports 52 per cent. were from Siam, 40 per cent. from Burma, 7 per cent. from French Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in August 1931 were 14,480 tons, as compared with 14,345 tons in July 1931.

The net imports of foreign rice into Malaya from January to August 1931 were 361,578 tons or 32,418 tons less than for the corresponding period of 1930.

Stocks of padi and rice held by wholesale dealers and millers in the Straits Settlements and Federated Malay States at the end of July amounted to padi 12,214 tons and rice 30,054 tons. These stocks, converting padi at 62 per cent., together with estimated stocks in Johore, on estates and for retailers in the Straits Settlements and Federated Malay States amounted to a total of 51,532 tons, as compared with 46,196 tons in the previous month.

India.—Total foreign exports of milled rice during January to July 1931 were 1,411,000 tons, a decrease of 605,000 tons or 30 per cent. as compared with the corresponding period of 1930, or 14.7 per cent. decrease as compared with the corresponding period for the past six years.

Burma exports of rice and rice products (including exports to India) from January 1 to August 15, 1931, were 2,652,320 tons, as compared with 2,671,477 tons for the corresponding period of 1930, or a decrease of 19,157 tons, or 0.7 per cent.

Japan.—It is reported that bad weather during the past three weeks of July has changed the rice policy of the Japanese Government. Exports of rice are being suspended and the balance of the Government's stocks will be retained in Japan, poor crops being indicated with almost complete failure in some districts.

Siam.—Deliveries of padi at the Bangkok mills from December 1930 to July 1931 were 610,320 tons as compared with 661,099 tons for the corresponding period of the previous year, a decrease of 7.7 per cent. and a decrease of 263,747 tons or 30.1 per cent. as compared with the average of the corresponding period for the past five years.

* The following is an abstract of the General Rice Summary for August 1931, compiled from various sources by the Registrar-General of Statistics S.S.

Exports of rice from December 1930 to July 1931 were 824,116 tons, an increase of 63,854 tons or 8.3 per ecnt. as compared with the same period the previous year and a decrease of 131,624 tons or 13.8 per cent. as compared with the average of the same period of the last five years.

It is reported that since August 1st., the Siam Rice Market has experienced erratic fluctuations due to local conditions, the chief factor probably being the lateness of rains preventing padi supplies coming out of the interior in July. Padi supplies were small in July and supplies held in Bangkok were being depleted. The damage to the crops by floods in China with a resultant firmness in the Hongkong and Singapore markets caused a sudden anticipation of a demand from China and prices of rice advanced; the price of white rice increased by 2 ticals in two weeks. The anticipated demand not having eventuated, rice prices declined by a little over a tical per picul in three days. Padi prices which had risen in line with rice prices, did not decline so rapidly as rice, and supplies were held up by padi speculators, the supplies during the second half of August being much less than during the first half. Since the end of August, there has been no increased demand from China, and prices have declined again and the market is weak.

It is also reported that the surplus available for export at the end of June 1931, in Burma, Indo-China and Siam was 1,400,00; 900,000; and 1,000,000 tons respectively, a total of 3,300,000 tons as compared with 1,000,000; 500,000; and 500,000 tons respectively, a total of 2,000,000 tons at the same period of 1930.

Java, Madura and N.E.I.—At the end of July, the area harvested amounted to 7,486,654 acres, a decrease of 132,385 acres or 1.7 per cent. as compared with the same period of 1930; the area damaged to 353,174 acres, an increase of 168,682 acres or 91.4 per cent. as compared with the same period the previous year; and the area standing to 1,116,712 acres, a decrease of 10,988 acres or 1 per cent. as compared with the same period of 1930.

Imports into Java and Madura, January to July 1931, were 172,959 tons as compared with 191,354 tons in 1930; and the imports into the Outer Provinces, January to June 1931, were 169,886 tons as compared with 193,431 tons in 1930.

French Indo-China.—Entries of padi at the port of Cholon (January 1 to August 31, 1931) were 807,200 metric tons, a decrease of 143,417 metric tons as compared with the same period the previous year. Exports of rice from Saigon for the same period were 731,675 metric tons, a decrease of 115,882 metric tons or 13.7 per cent. as compared with the same period of 1930.

At the beginning of August the padi market was very excited and prices soared rapidly as certain millers and exporters had to cover their sales. Towards the end of the month it became calm and there was a sharp downward tendency in prices. The stocks at Cholon are considerable in view of the amount of business offering. Owing to the failure of certain dealers the rice market acted in sympathy with the padi market. However, the prices remained firm when

padi dropped and still remain above the parity of other markets in spite of the lack of interest by foreign buyers.

Ceylon.—Imports January to July 1931, inclusive were 252,309 tons, a decrease of 29,905 tons or 10.6 per cent. as compared with the same period the previous year, and a decrease of 21,532 tons or 7.9 per cent. as compared with the average of the same period for the last five years.

Of the total imports in 1931, 16.5 per cent. were from British India, 74.7 per cent. from Burma, 0.3 per cent. from the Straits Settlements, and 8.5 per cent. from Cochin China and Siam.

Europe.—The quantities of rice shipped from the East during 1931 were :—

A. To Europe period January 1 to August 13, 1931, 799,254 tons as compared with 559,768 tons for the same period of 1930, being an increase of 42.8 per cent.

B. To the Levant, period January 1 to July 16,1931, 34,140 tons, an increase of 19,032 tons or 126 per cent. as compared with the same period of 1930.

C. To the West Indies and America, period January 1 to June 30, 1931, 107,155 tons, an increase of 24,859 tons or 18.8 per cent. as compared with the same period of the previous year.

MALAYA RUBBER STATISTICS — TABLE I

Stocks, Production, Imports and Exports of Rubber, including Latex, Concentrated Latex and Revertex, for the month of August, 1931, in Dry Tons.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	during the month: Foreign	during the month: From Malay States	during the year 1931: Foreign	during the year 1931: From Malay States	during the month: Foreign	during the month: Local	during the year 1931: Foreign	during the year 1931: Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Malay States:—																		
Federated Malay States	...	14,217	14,174	12,588	92,794	7,693	67,758	Nil	Nil	Nil	26	13,186	6,943	103,407	56,270	...	13,784	14,731
Johore	...	2,305	3,930	3,602	28,221	3,664	30.895	Nil	2	Nil	18	911	6,289	6,232	53,445	...	2,326	3,977
Kedah	...	411	2,347	2,266	16,671	1,027	8,311	Nil	Nil	Nil	Nil	782	2,459	5,049	20,172	...	454	2,356
Perlis	...	11	4	4	56	10	81	Nil	Nil	Nil	Nil	Nil	8	Nil	137	...	17	4
Kelantan ...	...	262	166	173	1,388	83	3,103	Nil	Nil	18	Nil	58	327	544	4,074	...	115	189
Trengganu ...	..	55	50	90	798	45	399	Nil	Nil	Nil	Nil	Nil	135	Nil	1,197	...	55	50
Total Malay States	...	17.261	20.671	18.728	139.928	12,552	110,547	Nil	2	18	44	14,937	16,161	115,232	135,295	...	16 751	21,307
Straits Settlements																		
Malacca ...	...	3,209	1,448	1,421	9,822			Nil		Nil		3,925		35,766		...	3,119	1,561
Province Wellesley	...	130	545	515	3,645	(2)	(2)	Nil		Nil						...	142	558
Dindings ...	...	115	121	100	760	2,584	15,900	Nil	16,203	Nil	135630	6,864	Nil	48,583	Nil	...	114	141
Penang	2,247	5,360	9	8	60			297		5,164						730	4,822	8
Singapore ...	5,125	33,835	322	169	1,433			7,097		65,113		17,106		146,009		4,887	34,196	280
Total Straits Settlements	7,372	42.649	2,445	2,213	15,720	2,584	15.900	7,394	16,203	70.277	135,630	27,895	Nil	230,358	Nil	5,617	42.393	2,548
Total Malaya	7,372	59,910	23,115	20,941	155,648	15,106	126,447	7,394	16,205	70,295	135.674	42,832	16,161	345,590	135,295	5,617	59,144	23,855

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
Dry Rubber	10,922	32,315	4,482	3,151	914	51,784
Wet Rubber	2,862	1,881	340	224	1.412	6,719
Total ...	13,784	34.196	4,822	3,375	2,326	58.503

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	26,153	225284
Penang ...	11,430	79,317
Port Swettenham.	5,154	37,708
Malacca ...	95	3,281
Malaya ...	42,832	345590

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	34,309	275003
Malaya ...	34,309	275003

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption. *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

METEOROLOGICAL SUMMARY, MALAYA, AUGUST 1931.

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day Amt.	Number of days: Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	89.9	72.6	81.3	95	70	83	75	84.4	85.0	4.00	101.6	1.67	9	8		1		183.55	5.92	49
Bukit Jeram, Selangor ...	88.6	73.5	81.1	93	70	82	77	85.3	86.8	2.66	67.6	1.05	8	6	1		1	202.15	6.52	53
Sitiawan, Perak ...	90.6	73.4	82.0	94	70	84	75	85.0	84.9	1.56	39.6	0.67	7	6				204.55	6.60	
Kroh, Perak ...	85.8	70.5	78.1	89	67	82	74	81.9	82.6	8.87	225.3	3.83	16	12		8		190.05	6.13	
Temerloh, Pahang ...	90.3	72.7	81.5	94	71	84	74	85.4	86.1	4.17	105.9	1.82	9	6	3	10		199.55	6.44	53
Kuala Lipis, Pahang ...	89.7	71.8	80.7	93	70	86	74	84.0	84.4	2.18	55.4	0.57	10	7	10	22	2	189.35	6.11	50
Kuala Pahang, Pahang ...	87.2	74.8	81.0	91	71	83	77	84.5	86.0	5.55	141.0	2.13	11	9	1		1	231.00	7.45	61
Mount Faber, Singapore ...	89.7	77.6	83.7	93	71	84	80	83.3	83.9	5.74	145.8	1.74	9	8				231.80	7.48	61
Butterworth, Province Wellesley ...	87.8	75.2	81.5	91	72	83	78	85.0	85.4	6.77	172.0	2.39	12	10			1	204.85	6.61	
Bukit China, Malacca ...	85.3	74.5	79.9	87	72	83	77	82.9	83.8	4.39	111.5	1.28	17	13	5			196.40	6.34	52
Kluang, Johore ...	89.0	72.3	80.7	93	69	84	75	82.7	82.9	3.53	89.7	1.69	13	10	2			196.60	6.34	52
Bukit Lalang, Mersing, Johore	89.6	72.7	81.1	92	71	85	75	82.9	82.9	7.99	203.0	2.15	12	11	4			219.25	7.07	58
Alor Star, Kedah ...	87.9	75.0	81.5	91	72	82	77	86.1	86.4	7.33	186.2	1.48	18	17	1			178.30	5.75	47
Kota Bahru, Kelantan ...	90.2	74.4	82.3	93	71	87	77	85.6	86.0	5.01	127.4	1.67	16	13	4			192.95	6.29	51
Kuala Trengganu, Trengganu	89.7	73.5	81.6	92	70	87	76	84.6	85.5	12.25	311.2	2.78	12	12	2	3		210.95	6.80	55
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	73.0	59.8	66.4	78	58	65	61			1.24	31.5	0.47	9	5		3	6	186.75	6.02	49
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.3	57.6	65.5	76	51	69	63	71.3	70.5	1.44	36.6	0.48	13	7		4		171.00	5.52	45
Fraser's Hill, Pahang 4268 ft.	73.8	62.6	68.2	78	59	67	65	70.5	71.5	4.36	110.7	1.29	10	10	2	11	2	166.65	5.37	44

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE

Malayan Agricultural Journal.

NOVEMBER, 1931.

EDITORIAL

Tapping Systems.

Systems of tapping rubber trees have passed through many phases, the controlling factors of which have been, firstly, the price of rubber and secondly, an appreciation of the effect of tapping on the health of the tree.

It is well known that in the earlier systems, a succession of cuts on the trunk of the tree was employed, resulting in the "herring bone" pattern of cuts. The system was abandoned as it was found that the consumption of bark was so rapid that insufficient time was allowed for bark renewal.

More conservative systems were therefore adopted which were designed to allow for as much tapping as was possible commensurate with the necessity of adequate bark renewal.

At that time the price of rubber dictated the heavy tapping which was universal in Malaya. The adverse effect of heavy tapping was the suspected cause of the well-known condition of the trunk of the tree known as brown bast, the occurrence of which frequently necessitated the removal of the affected tree and in any case, rendered a long resting period imperative.

But is was not until the advent of a slump in rubber prices which led to the Government restriction of exports that a revolutionary change was effected in tapping systems. The consequent curtailment in tapping resulted in more conservative systems being employed, such as smaller cuts, alternate day tapping and periodic tapping. Planters ultimately found that yields were rapidly re-established in spite of less frequent tapping, so that, on the abolition of compulsory restriction of exports, the new systems were generally retained. This increased yielding power of trees under conservative systems of tapping has proved a factor of considerable importance in reducing the costs of production during the present economic depression, when the price of rubber has fallen below the cost of production.

It will be seen, therefore, that whereas formerly the high price of rubber was a contributary cause of intensive tapping, which is expensive, the subsequent low price of rubber has led to more conservative methods in order to reduce costs of production.

Hitherto, no statistics have been available relating to the areas tapped under the different systems, so that the article which appears in this number, on "Rubber Tapping Systems on Estates" which covers all the tappable rubber on holdings of 100 acres and over in the Federated Malay States and Straits Settlements, provides the first reliable data on this subject.

It is shewn that 72.1 per cent. of the rubber is alternate day tapped, 20.6 per cent. on the A. B. C. System and only 7.3 per cent. is tapped daily.

It is significant that the Asiatic owned estates have not been slow to appreciate the advantage of alternate day tapping. Few, if any, of them have yet adopted the A. B. C. System, but the majority of them have changed over to the alternate day system.

Arrangements are now in hand to prepare statistics of the nationality of owners of estates over 100 acres each. It is thought that these figures will still further emphasise the fact that Asiatic owners of estates are becoming even more alert in adopting estate practices which lead to a conservation of their crop and the maintenance of their rubber trees in a good state of health.

No pronouncement can yet be made on the systems of tapping employed on holdings of under 100 acres each. Investigations on the bark consumption on small holdings are now in hand, but at least one year must elapse before any conclusion can be drawn from this work.

Improvement in Varieties of padi.

The method of improving yields of padi which provides the greatest opportunity of early results is by selection and cultivation of pure strains. In Malaya this work was first undertaken by the Department of Agriculture about 17 years ago and has given very material results. It is claimed that the yields of padi from the best selected strains are at least 25 per cent. higher than those of the original padi from which the strains were selected.

But there are definite limits to the improvement of yield obtainable by means of the isolation of selected strains and it is possible that we have now closely approached the maximum yield procurable by this method.

The possibility of further improvements by hybridization must therefore be explored. The article on "Hybridization of Selected Strains of Padi", which will be found in this number, is an account of the first steps taken in this direction. It demonstrates the difficulties which confront the investigator when attempting to cross-pollinate a cereal which naturally is self-pollinated. The perfection of the necessary technique is therefore of paramount importance, but it must be some time before any conclusions can be drawn from this work.

Liberian Coffee.

We have previously drawn attention in these pages to the opportunities that exist for coffee cultivation in Malaya. The annual importation of nearly 2 million dollars' worth

of coffee provides a starting point for encouraging a revival of this industry in Malaya.

The following article on "Liberian Coffee in Malaya" is designed to place before readers a statement of the position together with information on the methods employed in the cultivation and preparation of coffee. At a later date, it is proposed to supplement this information with an account of the investigations of the Department of Agriculture on this subject.

Palm Oil Machinery.

Previously, articles on palm oil machinery have been concerned with the systems actually employed on estates in Malaya, and on the technique of production. In this connection, the centrifugal and press systems have been the subjects of investigation. The article contributed to this number of the *Malayan Agricultural Journal* deals with the arrangement of machinery for the production of palm oil by the press system, and for the preparation of palm kernels. It must not be inferred, however, that the Department of Agriculture accepts responsibility for the information given in this article or advocates the adoption of any particular make of machinery.

Original Articles.

LIBERIAN COFFEE IN MALAYA

BY

J. N. MILSUM,

Assistant Agriculturist.

Introductory.

In a previous paper (1) information on the cultivation and preparation of coffee in Malaya was published. Since the appearance of this article the subject has received further attention with particular reference to the cultivation of Liberian coffee in Selangor at the present time. As is generally known, a considerable amount of interest was taken in the cultivation of Liberian coffee in Malaya during the years 1880—1898. In the Klang coffee district a large amount of British capital was invested, and estates were opened up in other districts of Selangor, Negri Sembilan and Pahang. Good profits were made in may instances until about 1898, when the price of coffee declined rapidly, due to increased production in Brazil. Interest then commenced in the planting of Hevea and the existing coffee areas rapidly became converted into rubber estates. During the present century the price of local Liberian coffee has fluctuated considerably, but for most of the period its cultivation appears to have been a paying proposition (2). The attraction of rubber, however, claimed almost entirely all agricultural enterprise. At the present time, the price of coffee, as with all tropical crops, is at a very low level.

The majority of the coffee plants grown in this country by Asiatics is Liberian, while several small estates devote their attention to Robusta. Much of this coffee is inter-planted with some other permanent form of cultivation, although certain areas are planted as a sole crop. Asiatic taste favours Liberian coffee, but a great deal of the coffee consumed is Robusta imported from Java. Owing to the very low price of coffee ruling at present and the demand for first class coffee only on the London market, the cultivation of Liberian coffee for export is undertaken only to a small extent. On the other hand, since the imports of coffee into Malaya are considerable, the production of locally grown coffee merits encouragement. The following table records figures obtained from official returns of the coffee trade in Malaya during 1930.

Table I.

Coffee Trade of Malaya in 1930.

	Raw		Tinned	
	Tons.	Value.	Pounds.	Value.
Imports	2,217	$2,612,890	636,480	$134,416
Exports	6,010	910,400	56,618	$162,593
Net Imports	3,793	$1,702,490	579,862	28,177

In Table II the official returns of acreage under coffee in Malaya at the end of the year 1930 are shown.

Table II.

Acrege under Coffee in Malaya at end of 1930.

Perak	...	583	acres.
Selangor	...	3,003	,,
Negri Sembilan	...	665	,,
Pahang	...	960	,,
Total F.M.S.	...	5,211	acres.
Straits Settlements	...	867	acres.
Johore	...	3,200	,,
Kedah	...	650	,,
Total Malaya	...	9,928	acres.

Cultivation in Selangor.

In Selangor, most of the coffee grown is Liberian and this appears the most suitable species for the conditions obtaining in the coastal districts. The alluvial clay soils of the coastal districts, when adequatey drained, are admirably suited to the growth of Liberian coffee. This species also thrives on good loam soil inland, but has proved unsatisfactory on sandy soils or areas where "laterite" occurs. It is commonly stated that while Liberian bushes will live for 20—30 years on the coastal soils, the life of the bushes when planted in inland districts does not exceed 10 years.

Although Liberian coffee is usually planted at low elevations, excellent growth has been observed with bushes growing on a good loamy soil at Gunong Angsi, Negri Sembilan, at 1,000 feet elevation.

A number of Asiatic holdings have been visited in the Kuala Langat District of Selangor and the following information represents a summary of the methods practised.

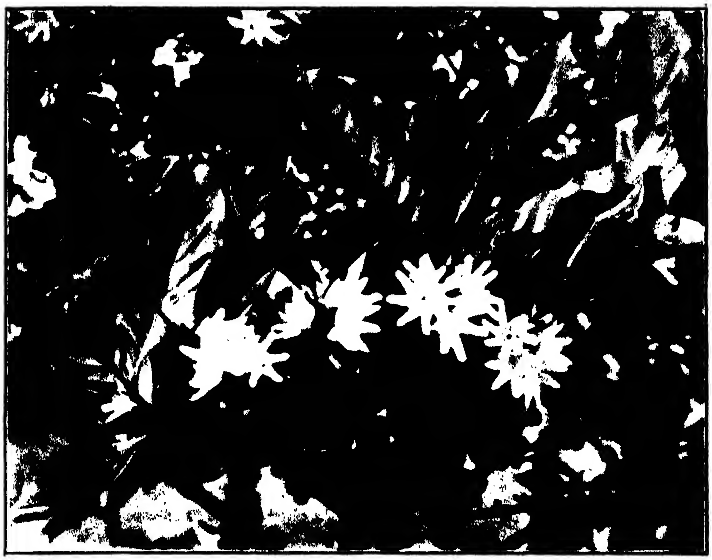
Cultivation :—Seeds are sown about 6 inches apart in raised beds in a shady situation and watered when necessary. Germination commences within 6 to 8 weeks from sowing and is usually completed within a further period of one month When the seedlings are 4 to 5 inches high and have 4 pairs of leaves, including the fish leaf, they are ready for transplanting. Under favourable conditions the seedlings are then 4 to 6 months old from germination. Experience has shown that, should the seedlings be allowed to remain longer in the nursery beds permanent damage may result owing to the young plants developing a bent tap-root The seedlings are planted 10 feet by 10 feet or 12 feet by 12 feet, square planting, that is 435 and 302 bushes per acre respectively. The wider spacing is preferable and should be adopted with the Liberian species.

Clean weeding is practised and on flat alluvial land is undoubtedly the most satisfactory form of cultivation On sharply undulating land in the Sungei Balak Chinese Settlement, Cheras, Selangor, poor growth of bushes has been observed, due mainly to loss of soil fertility from erosion.

When grown as a sole crop no shade is provided; past and present experience justifies this procedure since the use of shade trees with Liberian coffee results in increased growth of foliage with a consequent reduction of flowering Frequently, however, rubber or fruits trees are interplanted resulting in the bushes becoming heavily shaded and in course of time losing vigour. Pruning is attended to with some degree of skill. All bushes have a single stem demonstrating that attention is paid to suckering in the early stages of the plants' growth. The bushes are "topped" to within a height of about 6 feet, the cut being made through mature wood Pruning is undertaken monthly and consists of the removal of all suckers, shoots from the apex of the stem, and those secondary branches which arise within one foot from the main stem.

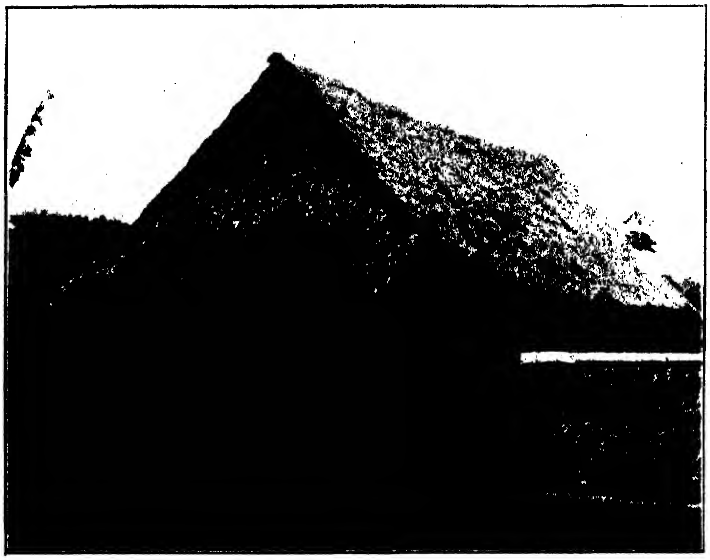
Yields :—Under suitable conditions, the bushes commence flowering when two years old and a small crop is obtained during the third and fourth years, increasing with the age of the plant. Actual records of yield obtained by Chinese cultivators are difficult to obtain, but returns of 5 to 6 piculs (650—800 lbs.) of prepared beans per acre per annum appear to be obtained.

A number of articles were published in the Kew Bulletin during the period 1890—1895 regarding the production of Liberian coffee in the Malay States. Table III represents a summary of yields from several estates in Selangor and Negri Sembilan during the year 1891 (3).



Liberian Coffee, showing Flowers and Berries.

Four-year old Liberian Coffee bush.



Coffee Store with Barbecue in foreground.

Winnowing Machine for separating Husks from Beans.

Table III.

Yield of prepared Coffee per acre for the year, 1891.

Estate.	Age of bushes (years.)	Area of fields acres.	Yield in Piculs.
Linsum Estate, Sungei Ujong. ...	11	62	7.97
Siliau Estate, Sungei Ujong. ...	10	36	7.45
Weld's Hill Estate, Selangor. ...	9½	65	6.90
Batu Estate, Selangor. ...	7	114	5.44

Yields from two estates in Sungei Ujong (Negri Sembilan) averaged 7 piculs of prepared coffee per acre per annum from three to four year old bushes. (1 picul = 133⅓ lbs.).

Manures.—Manuring consists of an annual application of rotted residue obtained during the preparation of the beans. The soil below the bushes is cultivated after the decayed husks are applied. The bushes, though in fair condition, would respond to systematic manuring.

Harvesting:—The two main cropping periods are May/July and December/February, but berries are collected throughout the year. During the principal fruiting seasons a labourer will pick about 20 gallons (or 130—140 lbs.) of cherry a day, which when prepared will yield about 20 lbs. of dry beans.

Preparation:—After plucking, the berries are placed to dry in the sun on an open clay barbecue for 6 to 7 days. During rainy weather a longer period is necessary. A portable dried palm leaf covering is employed at night and during rains. The heaps of berries are stirred three to four times daily to accelerate drying. The sun-dried berries are then collected and passed through a de-husker to remove the husk. The machines are made locally and consist of a hardwood or steel roller fitted with flanges so arranged as to exert pressure when rotated on the passing berries. This results in the partial removal of the dried pulp surrounding the beans. The intake is on the top of the de-husker and the husk and beans are discharged at the bottom. The rotating shaft is propelled by hand, usually four coolies being employed in manipulating the machine. Four hardwood blocks fitted on spokes are attached to each side of the shaft; this causes the roller to rotate at a regular speed. It is usually necessary to pass the dried berries three or four times through the de-husker before winnowing operations are undertaken. The winnowing machine is also made locally and is driven by hand. The husk and beans are separated by a strong draught of air produced by a rotating wooden fan. A device fitted below the intake controls the amount of husk and beans passing through the draught passage. It is frequently necessary to pass the beans through the de-husker again after winnowing. Subsequently the beans are sifted by hand several times over a bamboo hand-sieve with meshes about ¼ inch wide.

The beans are then bagged and sold to Chinese dealers. The preparation takes, during suitable weather, 9 to 10 days. Four labourers are able to prepare about 65 lbs. of dried beans per day.

The samples of beans produced by the method outlined are irregular, of dark colour and frequently retain a large amount of silver-skin. Lack of controlled fermentation is a further source of poor quality. Samples of Liberian coffee de-pulped as fresh berries by machine and correctly fermented, produce roasted coffee of superior flavour to that obtained by the dry method practised by local Chinese. Undoubtedly coffee of higher quality might be produced if it were possible to induce the growers to employ the wet-method of preparation.*

Malay cultivators frequently sell fresh berries to Chinese who make a margin of profit on the cleaned beans.

Diseases and Pests:—Evidence of coffee rust or leaf disease (*Hemileia vastatrix*) is noticeable in all areas, specially where soil conditions are poor. It is difficult, however, to estimate the actual damage caused by this disease. Caterpillars of the bee-hawk moth (*Cephonodes hylas*) occur periodically. An area of some 500 acres of coffee in the Klang districts suffered serious defoliation owing to a severe attack of this caterpillar during 1930.

References.

1. Cultivation of Coffee in Malaya. *Malayan Agricultural Journal*, Vol. XVIII, page 481.
2. The Cultivation of Liberian Coffee. *Agricultural Bulletin F.M.S.* Vol. V, page 431.
3. Liberian Coffee in the Malay Native States. *Bulletin of Miscellaneous Information, Kew.* 1892, page 277.

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* Described in the *Malayan Agricultural Journal*, Vol. XVIII, No. 10, October 1930.

RUBBER TAPPING SYSTEMS ON ESTATES

BY

D. H. GRIST,

Ag. Deputy Registrar-General of Statistics, S.S. & F.M.S.

The following observations are based on the returns prepared by each rubber estate of 100 acres and over in the Federated Malay States and Straits Settlements of production, acreage tapped and rested and method of tapping for the month of July, 1931.

The Statistics Department receives these returns monthly from all estates possessing mature rubber. The number of such estates in July was 1,306, of which 108 estates, representing 55,975 acres (37,917 acres in the F.M.S. and 18,058 acres in the S.S.) had entirely ceased tapping, while a further total area of 132,785 acres was out of tapping on estates that had partly closed down.

Excluding the above, there remains a total of 767,788 acres of tappable rubber on areas of 100 acres and over in the F.M.S. and S.S. The following figures relate to 744,760 acres or 97 per cent. of this area, the balance of 3 per cent. being represented by incomplete information supplied on the subject of tapping methods.

Table I.

Area under different systems of tapping in the F.M.S. and S.S.

Estates of 100 acres or more.

State or Territory.	Alternate Daily Tapping	Daily Tapping	A.B.C. SYSTEMS		
			Tapped	Rested	Total A.B.C. Systems
	Acres.	Acres.	Acres.	Acres.	Acres.
Perak ...	134,872	14,532	35,347	12,221	47,568
Selangor ...	165,961	9,351	34,672	18,329	53,001
Negri Sembilan ...	131,882	11,349	16,972	5,406	22,378
Pahang ...	17,745	4,693	1,974	644	2,618
Total F.M.S. ...	450,460	39,925	88,965	36,600	125,565
Province Wellesley ...	15,734	2,649	2,938	5,319	8,257
Dindings ...	3,397	625	465	72	537
Penang ...	70	351	—	—	—
Malacca ...	48,490	14,677	13,341	5,450	18,791
Singapore ...	8,680	6,552	—	—	—
Total S.S. ...	76,371	24,854	16,744	10,841	27,585

Table II.

Area under different systems of tapping in the F.M.S. and S.S.

(expressed as percentages.)

State or Territory.	Alternate Day Tapping	Daily Tapping	A.B.C. Systems		
			Tapped	Rested	Total A.B.C. Systems
	per cent.	per cent.	per cent.	per cent.	per cent.*
Perak ...	68.6	7.3	17.9	6.2	24.1
Selangor ...	72.7	4.1	15.2	8.0	23.2
Negri Sembilan ...	79.6	6.9	10.2	3.3	13.5
Pahang ...	70.8	18.7	7.9	2.6	10.5
Total F.M.S. ...	73.1	6.5	14.4	6.0	20.4
Province Wellesley ...	59.2	9.9	11.0	19.9	30.9
Dindings ...	74.5	13.7	10.2	1.6	11.8
Penang ...	16.6	83.4	—	—	—
Malacca ...	59.2	17.9	16.3	6.6	22.9
Singapore ...	56.9	43.1	—	—	—
Total S.S. ...	59.3	19.3	13.0	8.4	21.4
Total F.M.S. & S.S.	72.1	7.3	14.2	6.4	20.6

Tapping systems fall naturally into three categories: daily tapping, alternate daily tapping and rotational or periodic tapping—generally designated the A.B.C. system.

From reference to the accompanying Tables 1 and 2, it will be seen that during recent years the systems of tapping on Malayan estates have almost entirely changed from daily tapping to the more conservative method of alternate day tapping, while the tendency is for the adoption of the still more conservative method of rotational or periodic tapping. The figures show that at present 72.1 per cent. of this rubber is tapped alternate daily, 20.6 per cent. on rotational systems and only 7.3 per cent. daily. The daily tapping system is more common in the Straits Settlements than in the Federated Malay States. This is accounted for by the fact that in the Colony there is a larger proportion of estates owned by Chinese and other Asiatics than is the case in the Federated Malay States, and although it is observed that a number of Asiatic estates have adopted the alternate day system, the change-over from daily tapping is more protracted on Asiatic owned estates than on those owned or controlled by other nationalities.

Daily Tapping.—No case was found of daily tapping being performed over any large area with more than a single cut. The length of cut also tends to be short, so that there is doubtless ample time for bark renewal. The following percentages of the total area tapped daily shew that the more usual length of cut is ⅓ or ¼ of the circumference of the tree:

1 cut ⅓ circumference of tree	...	42 per cent.
1 cut ¼ circumference of tree	...	36 per cent.
1 cut ½ circumference of tree	...	9 per cent.
1 cut "V" on half circumference of tree	...	1 per cent.
1 cut mixed ⅓, ¼, ½, "V" etc,	...	12 per cent.

Alternate day tapping.—The most popular systems of alternate day tapping are a "V" on half the circumference of the tree, and a single cut on half the circumference of the tree. The first-named system accounts for 41 per cent. of the alternate-day tapped rubber, but this includes slight variations of the system, such as length of cut and the cutting of the right half "V" on one day, followed by the left half "V" on the following day. The single half cut is used on 24 per cent. of the areas under alternate daily tapping, while a mixture of methods is responsible for a further 15 per cent.

There remains, therefore, 20 per cent. of alternate day tapped trees which are accounted for by a number of methods such as single cut on ⅓ circumference, 5 per cent: ½ and ⅓ basal "V", 2 per cent: ½ spiral, which is particularly popular in Negri Sembilan, 5 per cent: and 2 cuts "V" on ½ the tree, 1 per cent.

Rotational, Periodic or A.B.C. Systems.—Under this system the estate is divided into blocks which in rotation are allowed a resting period. Reference to Table I shews that of the area at present under this system in the F.M.S. and S.S. 69 per cent. is being tapped while 31 per cent. is being rested.

The actual systems employed are so numerous and varied that it is not possible at the present time to prepare any figures as to the relative areas of land under each variation. This rather points to the fact that although the system of resting each block of land has been known and practised in Malaya for some time, the relative merits of the manner of effecting this are still in an experimental stage, so that no general or settled policy for estates has yet developed therefrom. It is significant of the ultra conservative policy adopted on most estates that 86 per cent. of rubber tapped under "A.B.C. Systems" is tapped alternate daily, while there appears to be a preference for a "V" cut. The tendency therefore is for the adoption of a scheme somewhat of the nature of a 4 months rest in 12 months, trees being tapped alternate daily on a "V" over half the circumference of the tree.

The area of rubber covered by the present discussion of tapping methods amounts to 62 per cent. of the total in the F.M.S. and S.S., the remaining 38 per cent. consisting of holdings of under 100 acres each. Statistics are not

available regarding tapping methods employed on such holdings, but it is certain that the amount of bark removed and the frequency of tapping is on a more liberal scale than is now customary on the larger estates.

The adoption of present day methods of tapping has no doubt been brought about very largely by the necessity for curtailing crops during the period when production was restricted by law, but it was early discovered that, although yields declined on the adoption of such methods of tapping, the trees quickly regained their yields, and at the present time the average yield of rubber per acre on large estates is higher than formerly and tends still further to improve.

There is little doubt that rubber trees on estates have now a big reserve of bark, that the health and yielding capacity is still further conserved by the present methods of tapping and that should the price of rubber justify the course, estates could, by the resumption of more drastic tapping methods, immediately increase yields for a limited period.

HYBRIDIZATION OF SELECTED STRAINS OF PADI

BY

R. B. JAGOE,

Assistant Economic Botanist.

Introduction.

Observations regarding the behaviour of the padi flower in pollination were first made locally by Jack † in 1919 and many of those observations are confirmed in this paper.

In the 1927—28 padi season these experiments on hybridization with padi were commenced at the Padi Experiment Station, Titi Serong, Krian, and were mainly instrumental in establishing useful negative information under local climatic and padi growing conditions.

During the following season, a simple technique was developed for "crossing" which probably would have been successful but for the very severe infestation of padi by stem-borers (*Diatraea auricillia*, Dudg., *Schoenobius incertellus*, Walk., *Sesamia inferens*, Walk.,) which occurred in Krian and elsewhere and which affected a great many of the tillers in the breeding cage and thus reduced the material available for experiment. Also, where successful crossing had been accomplished and grains were developing, borer-affected stems withered before the grains had fully matured while they were still in the "milk" stage. Consequently, very few grains matured and many of those which did ripen were too weak to survive germination.

In 1929—30, however, with greater experience and somewhat better conditions, the technique was improved, and very moderate success was obtained.

In this season also, serious infestation by stem-borers was again experienced so that the health of the plants in the breeding cage was much affected and again abnormal conditions militated against success. The stem-borer infestations were helped by unfavourable growing conditions for the padi due to long spells of dry weather which greatly retarded padi planting operations.

Flowering.

With the varieties grown at Titi Serong Padi Experiment Station, flowering begins 3½ to 6½ months after sowing when the panicle of the young, almost colourless, flowers emerges from the sheathing leaves. The flowers rapidly gain

† Preliminary Report on Experiments with wet Rice in Krian by H. W. Jack—*Agricultural Bulletin F.M.S.* Vol. 7. 1919.

* A Preliminary Account of Three Rice Stem-Borers by H. T. Pagden Bulletin No. 1 Scientific Series, Dept. of Agriculture, S.S. and F.M.S., June, 1930.

colour, usually greenish, and the stalk continues to grow another 12 or 18 inches during the following fortnight.

The flowers mature from the top and open irregularly in succession, requiring 6—8 days for all to open, depending on weather conditions especially on sunshine.

By looking at a flower against the light, the position and outlines of the anthers can be distinguished in the lower quarter of the flower, and in the early morning of the day on which the flower will open fully the anthers may be seen to rise inside the still closed flowers, being pushed upwards by the elongation of the stamen filaments. This elongation of the filaments commences a couple of hours before the flower opens, which it does quickly, usually at about 11 a.m. and the stamens protrude to their full length. The palea and lemna continue to move apart for a few seconds till they make an angle with each other of about 30° when fully open.

Self-pollination is usual and occurs at or immediately after the opening of the flower. The stigmas usually protrude one on each side and the overhanging anthers shed pollen on them. The stamens eventually drop over and fall away and in 20—30 minutes the flower closes up again with the stigmas still protruding and commencing to wither.

Regularity and time of flowering is affected by the health of the plants, and by atmospheric conditions.

The daily period of opening of flowers from unhealthy plants is much extended and wet or dull weather generally retards the hour of opening.

The amount of natural cross-pollination must be non-existant or very small indeed with healthy plants and in fine weather. In adverse weather conditions dehiscence of the anthers is delayed and may lead to a small amount of natural cross-pollination.

Method of Crossing.

The following is the method now adopted at Titi Serong for cross-pollination.

A panicle is selected on the plant to be used as the female parent, preferably one which has just commenced flowering as shown by 5 or 6 opened flowers near its apex. In the cool of the evening before dark (about 5.30 p.m.) the selected panicle is deprived of all its spikelets except about 10 well-formed ones.

These are emasculated by drawing out the stamens with a delicately sprung forceps after snipping off the tops of the lemna and palea about ¼—⅓ of their length from the apex with a sharp fine scissors, cutting off a little more of the lemna than of the palea. It is wise to use a good lens while emasculating, and the emasculated flower should be carefully examined afterwards for pollen grains. The forceps should be thoroughly cleaned or sterilized after each operation.

If any of the anthers burst in the process of emasculation, the flower is cut away, but this rarely occurs when emasculation is done in the cool of the evening. Emasculation of the higher spikelets on the panicle should be done first.

The panicle is then enclosed in a fine butter-muslin bag suspended over the panicle and expanded by a simple wire frame. The following day, just before flowering time (which is between 10.15 a.m. and 11.30 a.m. with the maximum rather before 11 a.m.) a panicle of the plant to be used as the male parent is chosen, which bears flowers that are opening. This is cut off with a fairly long stalk, put in a test-tube of water and carried to the hybridization cage.

The bag enclosing the emasculated panicle is withdrawn; anthers from the male parent are burst over each emasculated flower causing them to shed pollen on to the stigmas. The panicle is then re-enclosed within the muslin bag.

Bagging.

A fine butter-muslin bag is used because protection is necessary for the cut flowers between emasculation and setting of grain and afterwards against Leptocorisa spp. and other insect pests. The bag is kept in position until the grain has passed the milk stage for this latter reason. The bag used is of muslin because of the excessive transpiration which causes the atmosphere within glacine paper bags to become so humid that the flowers rot, while with a butter buslin bag evaporation is possible.

Maturation of Grain.

Examination was carried out by dissection of ordinary self-pollinated flowers of Radin 2, at hourly intervals from 12 mid-day to 6 p.m. and from 6 a.m. for the first twenty-four hours, and then at daily intervals at 11 a.m.

Twenty-four hours after pollination the ovary of the flower of Radin 2 padi is 1 m.m. in length. There does not appear to be any change in size until after 21 hours when the commencement to enlarge is just perceptible. After

2 days the length of the developing rice grain is	1.25 m.m.
After 3 days the length of the developing rice grain is	2.50 m.m.
After 4 days the length of the developing rice grain is	4.00 to 4.50 m.m.
After 4 days the length of the developing rice grain is	6.00 to 6.50 m.m.
After 5 days the length of the developing rice grain is	7.00 m.m. and is just filling the husk.

After 6 days the husk is fully filled, but the rice is still in the "milk" stage, and takes about another 24 days to reach full ripeness.

Results to date.

As has already been stated, moderate success was obtained in the 1929—30 season. Over 100 grains were obtained from cross-pollinated flowers. Of

these only 25 germinated in August 1930; 16 grew to the seedling stage but only 10 developed fully.

Reciprocal crosses were made with Radin 2, Radin 4, Radin 7, Radin 13, Seraup Kechil 36, Seraup Kechil 48, F.S. 27, and Pahit 1, and pollen was used from two or three other varieties also. There were numerous failures to set grain, particularly at the beginning of the experiments and at the end of the season.

Below are details of certain specific cases in which alone grain set.

The fully formed kernal from a flower of which the tops of the lemna and palea had been cut off was constricted and attenuated above the point of exposure, but was quite normal in all other respects.

The following set grain after the pollination of 10 flowers in each case, but failed to germinate :—

R. 2 X	F. S. 27 S. B. 48 S. K. 48 R. 7 F. S. 80	F. S. 27 X	R. 2 R. 4 S. K. 48 F. S. 824 R. 7 (twice) F. S. 44
S. K. 48 X	R. 2		

Seeds from the following crosses germinated satisfactorily but failed to develop into mature plants.

R. 2 X	F. S. 27 S. K. 36
S. K. 48 X	R. 4
F. S. 27 X	R. 7

Crosses R. 2 X F. 27 (8 plants) and R. 2 X S. 36 (2 plants) germinated and produced very robust mature first generation hybrid plants which gave an abundance of ripe F. 1. seed.

Additional Notes on Emasculation.

Emasculation was usually done in the evening as it was easier and more successful, but it was occasionally done in the morning before the flowers commenced opening.

With reference to emasculation in the morning, it might be mentioned that it was found easier to operate at about 9 a.m. than at 7 a.m. because it was safer to wait until the stamens had elongated somewhat so that the forceps could be inserted beneath the anthers without damaging the stigmas and at any time in the morning the anthers of mature flowers required more careful handling than on the previous evening.

It was found quite impracticable to emasculate before the panicle had properly emerged from its sheath, as the flowers were so delicate that it was almost impossible to avoid damaging them severely.

(i) The palea and lemna of nearly mature flowers were gently forced apart and the anthers removed with a fine scalpel or forceps. Emasculation was successfully done in this way, but it was tedious. Moreover, the rigidity of attachment of the palea to the base of the flower almost invariably resulted in the delicate brittle base of the flower being damaged, so that even in successful cases of cross pollination, when the flower set grain, the development of the grain would cease after a day or two because of the damage to the vascular system.

(ii) The tops of 10—20 flowers on a panicle were snipped off, other flowers being removed. The panicle was protected, and the elongation of the stamens awaited. When the stamens were fully elongated the anthers were exposed outside the flower and easily removed.

This was not so convenient a method as early emasculation, and furthermore, in fully 50 per cent. of the flowers at least one of the anthers shed pollen as it was being pushed out.

It will be noted that the female parent of all the successfully grown plants was Radin 2. It is a robust growing variety of early padi and is easier to emasculate than most others. By reason of its earliness it was able partially to avoid the peak of the stem-borer infestation.

Radin 2 is a favourite rice with most Malays for its eating qualities, and is a fairly heavy yielder.

The male parent F.S. 27 is a Nachin type of short maturation period. It is a good milling padi and has sturdy straw. The rice also is popular for eating.

The male parent S. K. 36 is the highest yielding of all of Jack's selected strains.* It is a late maturing variety of excellent milling grain.

The hybrid seeds were sown on 4.8.30, flowering commenced on 14.12.30, and grain ripened on 19.1.31 The average number of tillers was 40.

These plants were very similar to the female parent type in growth habits and in general appearance, but the grain showed distinct evidence of hybridity.

The F. 1 generation seed will be sown next July and a further description of the experiments. including details omitted in this short account and with additional results, will follow in due course.

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*Rice in Malaya, H. W. Jack. *Malayan Agricultural Journal, 1923.*

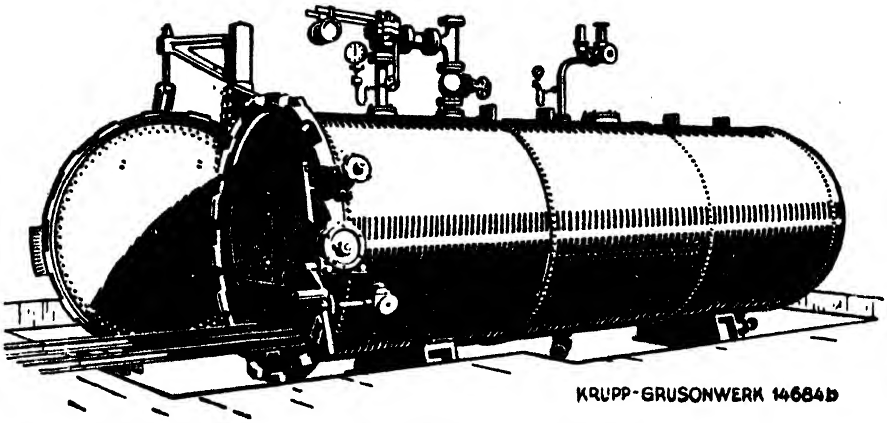
THE PRODUCTION OF PALM OIL ON A LARGE SCALE *

BY

R. Siebert,

Dipl. Eng. Memb. of V.D.I.

As there will be a considerable acreage of oil palms coming into bearing shortly and several grants of land have been made for planting oil palms on a large scale, the paramount problem facing the industry is how to reduce production costs and to increase the recovery of oil to the maximum. It might therefore be of interest to producers generally to have particulars in regard to a method of dealing with oil palm fruit on a large scale by a treatment which is known and usually called after one machine viz. "the swing press system".



HORIZONTAL STERILISER WITH VACUUM. (fig. 1)

The method of treatment described herein is characterised by an endeavour to bring down the cost of treatment to the smallest possible figure and at the same time produce an oil with a very low free fatty acid content. At present the premium obtained for oil of a low acidity is very small but in due course the superiority of such oils will no doubt be recognised.

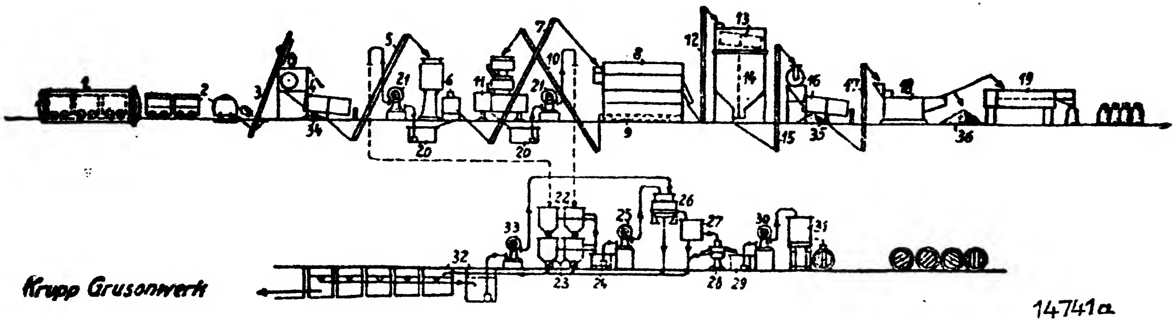
The machines used in this swing press system were devised as a result of more than 25 years' experience of palm oil machines and the method is, with slight variations to meet certain local conditions, in use in various parts of the world for the treatment of the output of about 150,000 acres of oil palms.

It should be mentioned that for an estate of under 1000 acres, single pressing would give the greatest economical advantage, whereas on larger estates the use of screw presses for a second pressing would shew the best results.

The working of such a plant following the scheme on page 536 would be as follows:—

* The following contributed article gives a concise account of an up-to-date factory for the preparation of palm oil and kernel on a large scale. It must not be inferred, however, that The Department of Agriculture accepts responsibility for the information or advocates the adoption of any particular make of machinery.

Main Points in connection with PALM OIL PLANTS capable of recovering up to 96% Oil.



A. Sterilization of fruit and seperation of same.

1. Horizontal sterilizer.
2. Containers for bunches
3. Inclined elevator.
4. Stripper with screening drum.

B. Production of Palm Oil.

5. Inclined bucket elevator.
6. Hydraulic fruit press with swing cage.
7. Inclined bucket elevator.
8. Continuous pulping and drying drum.
9. Worm conveyor for pulp fibres.
10. Inclined bucket elevator.
11. Automatic Oil Expeller with duplex heating kettle.

C. Production of Palm Kernels.

12. Bucket elevator.
13. Grading cylinder for nuts.
14. Silo for nuts.
15. Bucket elevator.
16. Centrifugal nut cracker with screening drum.
17. Bucket elevator.
18. Palm-kernel separator.
19. Dryer for palm kernels.

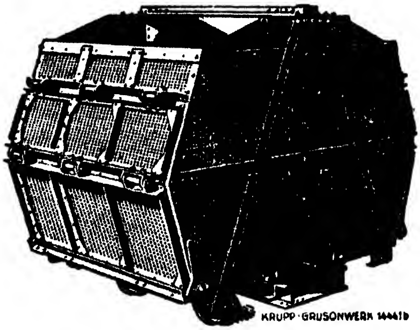
D. Purification of the Oil.

20. Crude-oil tanks.
21. Oil pumps for crude oil.
22. Oil purifier.
23. Oil and fruit-juice separator.
24. Tank for preliminarily-purified **oil.**
25. Oil Pump.
26. Steam-jacketed oil kettle.
27. Settling tank.
28. Centrifugal Oil purifier.
29. Oil tank.
30. Oil pump.
31. Draw-off oil tank.
32. Pit for recovering the **residual oil from the fruitjuice and water.**
33. Oil pump.

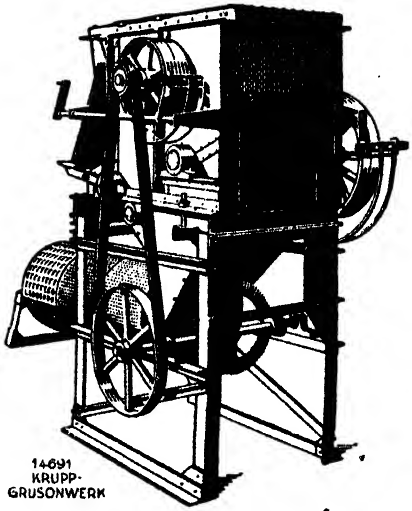
The figure numbers in the text refer both to the above "lay-out" of the machinery and to the illustrations that accompany this article.

A. Harvesting, Sterilising and Stripping of Fruits.

The selected ripe fruit bunches are harvested and collected in containers (fig. 2) and transported to the factory on a light railway. As these containers are designed to fit the sterilisers (fig. 1) the bunches, after having gone over the weigh bridge, pass without being unloaded direct into the sterilisers.



CAGE INTO WHICH THE BUNCHES ARE HARVESTED IN THE FIELDS AND IN WHICH THEY ARE STERILISED.
(fig. 2)

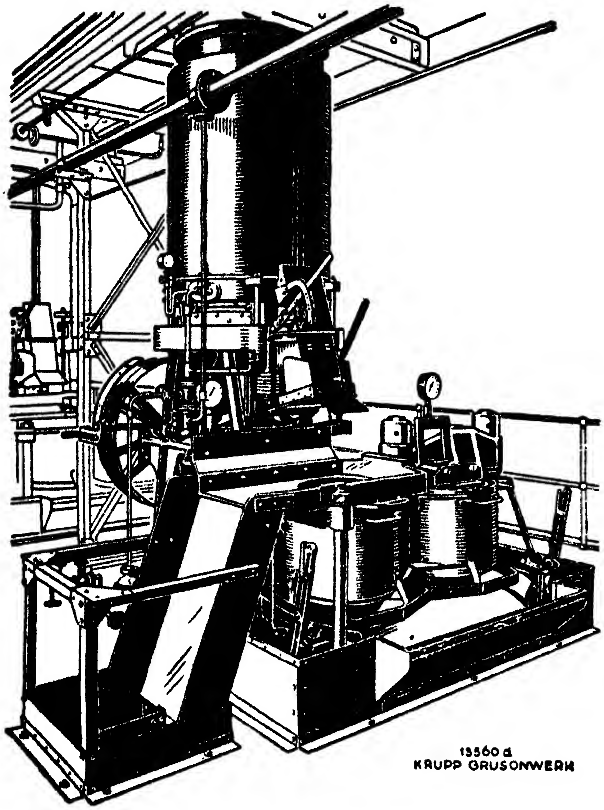


STRIPPER (B. PAT.) WITH SIMPLE DISCHARGE FOR TRUNKS BY MEANS OF LIFTING A FLAP.
(fig. 4)

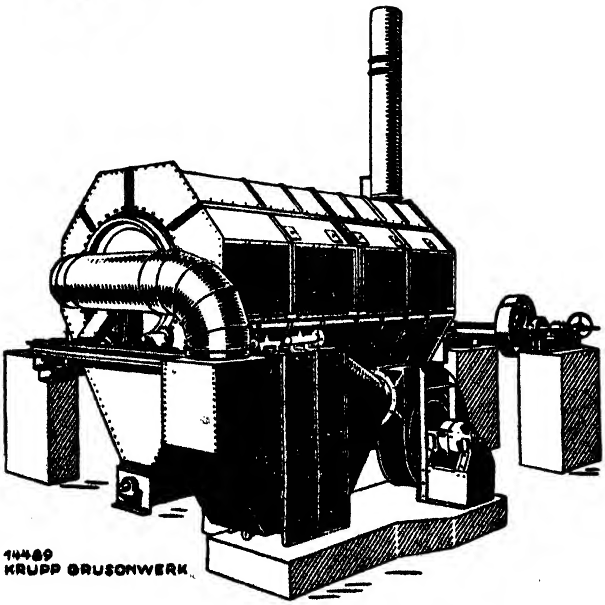
The destruction of the naturally occurring enzymes and the loosening of fruits is achieved by treating the bunches with live steam of low pressure. The bunches are then dried and deodorized by applying a vacuum. The rapid locking device at the back of the steriliser having been opened, the containers are withdrawn, the bunches discharged and lifted by an elevator (fig. 3) to the stripper (fig. 4.) This stripper being of a special patented design readily threshes the fruit from the bunches by means of revolving beaters. The trunks are discharged by lifting a flap and the small stalks and leaves are separated by a sieving drum.

B. Digesting and Pressing by Swing Cage Press and Expeller.

The palm fruit delivered by the stripper is lifted by the elevator (fig. 5) to the steam jacketed digester (fig. 6) (fruit boiler) to disintegrate the oil cells by heat and to form a pulp by the therein rotating agitator. Underneath the digester is the swing cage press (fig. 6) which consists of two cages, which are simultaneously first under low and then under high pressure. The press it attended to by one man only, gives an oil yield of more than 90 per cent. and has a capacity of between 1200—3000 pounds of fruit per hour, this depending upon the pressing time and the use of accumulators. A protecting box effectually restrains the oil from spraying about. The cake is now passed by means of an elevator (fig. 7) to a continuous working pulping and drying drum (fig. 8) in which the pulp is separated from the nuts under a current of hot air.

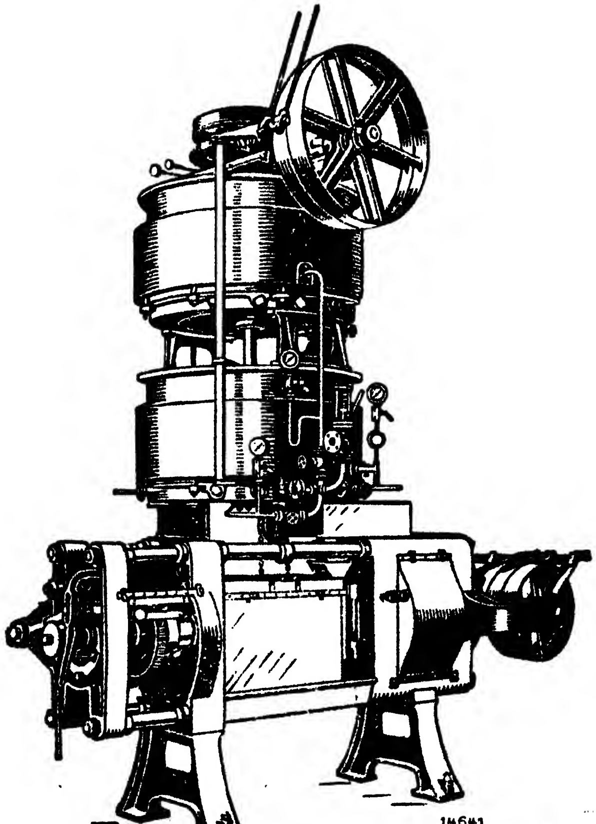


SWING CAGE PRESS.
(fig. 6)



DEPULPER AND DRYER FOR THE CAKE FROM THE SWING CAGE PRESS.
(fig. 8)

The dried separated pulp is then discharged into a screw conveyor (fig. 9) and lifted by an elevator (fig. 10) to a double heating kettle to be redigested. From this it passes direct to an expeller, (fig. 11) which by means of a screw, presses out the last drop of oil available. (When properly treated the oil content: of the cake should amount to 9 per cent. only, calculated on dry residue).

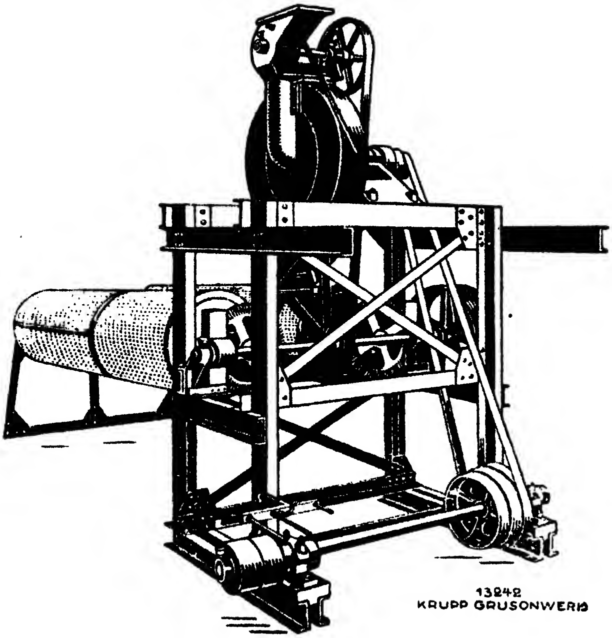


EXPELLER WITH DOUBLE HEATING KETTLE FOR EXTRACTING THE OIL FROM THE PULP.

(fig. 11)

C. Production of Palm Kernels.

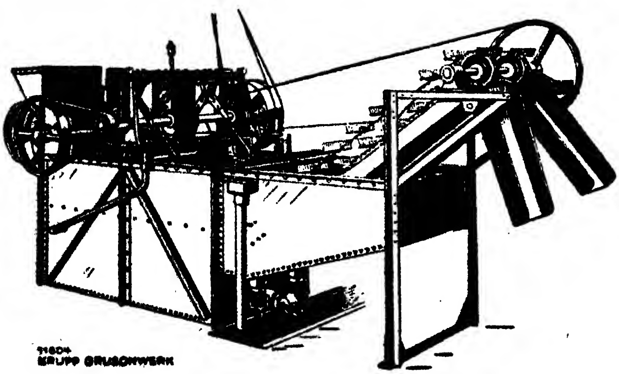
The clean and dry palm nuts discharged by the depulping drum are lifted by elevator (fig. 12) to a grading cylinder (fig. 13). Underneath this there is a silo consisting of two compartments, one for the larger and the other for the smaller nuts, which are by bucket elevator (fig. 15) fed separately to the cracker (fig. 16).



NUT CRACKER WITH SCREENING DRUM.

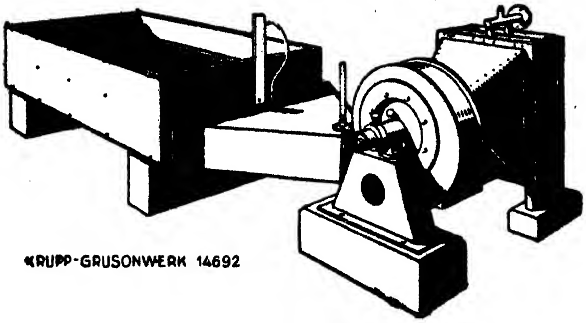
(fig. 16)

The kernels are separated from the small shells and the shells which are larger than the kernels by a sieving drum arranged under the cracker. The kernels and the shells of the same size are lifted by a bucket elevator (fig. 17) to the palm kernels separator, (fig. 18) which works without any addition of clay or salt on the jig prinaple. The kernels are dried on a kernels dryer (fig. 19) by heated air, and after cooling bagged for transport.



KERNEL SEPARATOR WITH JIGGING MOTION.

(fig. 18)



KERNEL DRYER. HOT AIR PROCESS.

(fig. 19)

D. Purification of the Oil.

The crude oil collected in the oil tanks (fig. 20) is pumped (fig. 21) to the oil purifiers (fig. 22) where it is led through water which has been heated by steam coils. The oil from the surface is drawn off by a tilting pipe to a tank (fig. 24) to be collected for further treatment in the steam packeted oil heating kettle (fig. 26). The miscellaneous coagulated matter, however, is with other impurities drawn off from the bottom into an oil and fruit juice separator (fig. 23), to be treated by water and steam, until such time as the last drop of oil is capable of being skimmed off into the collecting tank (fig. 24). From here the oil is pumped (fig. 25) to a steam-jacketed boiler (fig. 26) where the slimy ingredients are coagulated. The oil, after having settled in a settling tank, (fig. 27) is passed to the centrifugal cleaner (fig. 28). This centrifugal cleaner separates the last traces of water and impurities. Thus in a few hours the oil is ready for transport and is packed from a draw off tank (fig. 31) into barrels or pumped into tanks if shipment in bulk is required.

The fruit juice and all other liquids which come from the steriliser, various tanks and machines are collected for settlement in a pit (fig. 32) before being allowed to flow out of the factory. By this arrangement and by assaying the cake from the expellers the loss of oil for the whole plant is under control of the manager and the highest recovery possible is assured. This in favourable conditions (ripe fruit working on a large scale) should amount for *the whole plant* to more than 96 per cent.

Abstracts.

PREPARATION OF PINEAPPLE BRAN.

A note on pineapple bran which appeared on a previous number of this Journal has brought several enquiries concerning the machinery necessary and the cost of preparation.

Particulars of the machinery, as supplied to the Hawaiian canneries, have now been received from the makers in Colerado, whose address can be supplied on application to this Department.

The following figures are based on Hawaiian fruit and conditions.

The average sugar content in the juice is 10—12 per cent., the range being from 9—14 per cent., while the average fibre content in the waste is 4 per cent. (4—4.5 per cent.)

Although no description of the working of the plant is given, it would appear that the machinery consists essentially of a coarse shredder, a press, a fine shredder and a drier unit.

The waste is passed through a shredder which effects a coarse shredding. It is then pressed to extract as much as possible of the liquid. With single pressing only, the extraction in juice is about 25 per cent. on fruit or 50 per cent. on waste to be pressed, and 4.4 to 4.8 per cent. dry bran on fruit or 8.8. to 9.6 per cent. on waste from cannery.

Providing double pressing (first and second pressing) the juice extraction is 37.5 to 38 per cent. on fruit (75 to 76 per cent. on waste) and 3.3 to 3.5 per cent. bran on fruit or 6.6 to 7.0 per cent. on canning waste (66 to 70 lbs. of dry bran per ton fruit entering the cannery).

Single pressing requires less horse power but increased fuel for drying and gives the maximum bran yield. Double pressing requires more horse power but decreased fuel for drying and yields less bran.

1 ton of fruit gives 1,000 lbs. waste. The first pressing yields 500 lbs. juice leaving 500 lbs. waste of about 80 per cent. moisture. The second pressing gives a further 250 lbs. of juice leaving approximately 250 lbs. of waste of 76 per cent. moisture to be dried to 10 per cent. This on drying will give 66 lbs. of bran of 10 per cent. moisture or 3.3 per cent. on fruit processed.

The specifications shew that the pressed waste is passed by a conveyor to a Buittner type drier, but the length of time required for drying the bran is not stated.

It is stated, however, that if the cannery is very small, it may be advisable to hold the bran for one or two days and then to dry a two or three days' accumulation together if the temperature and humidity permit this and fermentation is not too rapid.

Specifications.

"For all machinery from shredder to sacking scroll of bran for a capacity of 6 tons of pineapple per hour and finished bran up to 600 lbs. per hour, including the complete plant except prime mover.

1. One No. 5 type C shredder A for coarse shredding of waste.
2. One feed hopper of chrome nickel steel.
3. One No. 0 pine waste press.
4. One No. 5 type C shredder B for fine shredding.
5. One elevator conveyor to convey pressed waste to drier.
6. One complete 3 feet 3 inches Buittner type drier unit consisting of drier with supporting and driving arrangements, spirale, housing, cyclone, fan, and complete furnace with fire brick.
7. One complete oil burning arrangement for furnace, consisting of burner, pump, heater, piping and storage tank.
8. One dry bran scroll and elevator and sacking scroll.
9. The complete shafting, bearing, pulleys, belting and hoppers, and chutes."

Any size of plant up to 50 tons of fruit hourly capacity can be supplied.

The Malayan factories are usually small, and it is possible that a plant up to 10 tons hourly capacity would be suitable in most cases. Two or three men would be required to operate such a plant.

The present cost of the plant detailed in the above specification is $20,600 (Gold) F.O.B. San Francisco, California, while the 12-ton hourly capacity plant is quoted at $26,400 (Gold).

The address of the makers of this machinery will be given on application to the Department of Agriculture, Kuala Lumpur, while those interested may have access to the letter from the makers which supplies information additional to the above. (Reference D.A. 539/31).

THE MALAYAN RUBBER INDUSTRY IN 1930*

The following is a tabulated statement of the rubber statistics of Malaya contained in the Report :—

Area and Production of Rubber in Malaya, 1930.

State or Territory.	Area planted in 1930	Total area end of 1930	Production 1930 (tons.)		
			On estate over 100 acres	On small holdings	Total production.
Perak ...	6,273	525,707	44,617	—	—
Selangor ...	2,869	483,303	52,000	—	—
Negri Sembilan ...	5,829	337,018	38,432	—	—
Pahang ...	3,803	129,928	5,740	—	—
Total F.M.S. ...	18,774	1,475,956	140,789	110,206	250,995
Singapore ...	7	50,174	2,657	—	—
Penang ...	50	63,481	123	—	—
Province Wellesley ...	212	12,984	5,693	—	—
Malacca ...	1,060	198,888	14,827	—	—
Dindings ...	90	14,890	1,175	—	—
Total S.S. ...	1,419	340,417	24,475	38,770	63,245
Johore ...	Figures not available.	705,298	42,758	—	—
Kedah ...		289,942	24,210	—	—
Kelantan ...		73,066	3,114	—	—
Trengganu ...		47,991	1,333	—	—
Perlis ...		5,000	96	—	—
Total U.M.S. ...		1,121,297	71,511	66,113	137,624
Grand Total Malaya ...		2,937,670	236,775	215,089	451,864

For comparison the net export figures for the three previous years are given :—

		Rubber, tons.	Latex, Galls.
1927	...	188,456	1,560,976
1928	...	258,906	919,909
1929	...	415,608	1,708,529

Similar data for rubber for the Netherlands East Indies and for Ceylon are shewn below for comparison :—

		N. E. Indies tons.	Ceylon tons.
1928	...	226,000	56,000
1929	...	259,000	80,500
1930	...	170,000	75,000

*** Abstract from the Annual Report of the Department of Agriculture, S.S. & F.M.S. for the year 1930 by H. A. Tempany, D.Sc., F.I.C., F.C.S., Director of Agriculture, S.S. & F.M.S.**

During the year it was decided to suspend further alienation of land for rubber planting throughout Malaya and since September, 1930, no fresh alienations have been made, consequently additions to the planted areas so far as is known have since that date only occurred on land previously alienated.

Economic Conditions of the Rubber Industry.

The sale price of rubber during 1930 fell to the lowest figure in the history of the industry. The average Singapore price of first grade smoked sheet during the four quarters of the year was as under:

First quarter 25 cents per lb., Second quarter 22½ cents per lb.,
Third quarter 15½ cents per lb., Fourth quarter 13¼ cents per lb.

In an attempt to reduce stocks and so improve the price, a "tapping holiday" was agreed upon during the month of May. This was very generally observed by the owners of big estates (i.e., those of 100 acres or over), with the result that the crop harvested in the Federated Malay States in May on such estates was only 1,688 tons as compared with 11,137 tons harvested in April. The smaller holdings did not observe this holiday and it is agreed that its effect upon the sale price of rubber was negligible.

Later in the year official conversations between the Governor of the Netherlands East Indies and the High Commissioner for the Federated Malay States were arranged. During these the question of the possibility of imposing some form of restriction of output or export to be enforced by the Governments concerned was discussed. It was later announced that no official steps to restrict the export or production of rubber were contemplated.

Towards the end of the year a number of estates and of the poorer small holdings had ceased tapping wholly or in part, and it is estimated that at the end of the year the area out of tapping in the Federated Malay States and Straits Settlements, respectively, was as follows:

Federated Malay States	133,213 acres.
Straits Settlements	32,373 acres.

Conditions on Estates.

Throughout Malaya the larger estates on the whole maintained the normal standard of upkeep throughout the year, but especially during the later months some curtailment of fieldwork became inevitable as the result of the low price of rubber; staffs and labour forces were curtailed, salaries and labourers' wages were reduced, and tasks were increased with the sanction of the Labour Department, while a considerable number of Indian labourers had been repatriated up to the end of the year; so far as is known no estates had been abandoned, but a continuation of existing conditions must inevitably lead to the elimination of the weaker units.

Considerable economies in production have been effected and many estates have found it possible to reduce their f.o.b. cost of production to 10-12 cents per lb. Straits currency, a figure which, however, leaves little or no margin for profits and allows nothing for improvements.

Continued attention has been given by estates to the planting of high yielding clones of budded rubber. During the year importation of budwood from the Netherlands East Indies was continued, but the quantity imported was less than in 1929, a result partly due to financial reasons, and partly to the increasing production of budwood from estates' multiplication nurseries.

The total area of budded rubber in the Straits Settlements and Federated Malay States at the present time is estimated to be 73,500 acres. It is known that large areas in Kedah and Johore have been budgrafted: figures will be published later. Several new clones of great promise have also been discovered and records of them are now being kept by the Rubber Research Institute.

Records of high yielding mother trees on a number of estates have been continued and buddings of some of them have already been made at the Rubber Research Institute Experiment Station. It is anticipated that a number of valuable Malayan clones will be derived from these trees.

Numerous enquiries dealing with the technique of budding have been received by the Rubber Research Institute and dealt with, while advice is being freely sought by and given to estates on the suitability of the best known clones and their establishment either as pure clones in blocks or as mixed plantings.

Many estates are also now prepared to plant blocks of single clones which have a sufficiently long record of tapping and which have not developed any defects.

In view of the fact that most planters are now convinced of the value of budding, interest has also been taken in the high budding of 2½ to 4-year old stock and small areas have been budded at 18 inches and higher.

Interest in questions of soil management and systems of soil conservation has continued to extend; present practice on the whole favours silt pitting and bunding combined with clean weeding as the most satisfactory system, as against the establishment of cover crops and the question has been raised as to whether the establishment of heavy covers does not tend to diminish latex yields. The question is under investigation.

Interest in manuring has also tended to expand. The successful results obtained in Sumatra in raising latex yields by manuring have stimulated activity in this direction, and many estates have now embarked upon experimental programmes of manuring. It is now generally recognised that the problem of manuring rubber is a specialised one differing from that of the majority of other crops, inasmuch as the amount of plant food removed by the crop is practically negligible, and manuring is required rather as a stimulant to growth and as a means of replacing losses which have occurred in the past owing to defective soil management than as a consequence of continued cropping.

Continued investigation has shown the value of applying nitrogenous fertilisers on a number of estates, while on others evidence has accumulated which indicates that response to potash fertilisers is obtained.

An important fact to bear in mind is that in the first instance, attention should be paid to medium yielding areas and areas which show initial signs of deterioration. Some very bad areas cannot be treated economically, while on some estates, increased yields due to manuring will be delayed till the vegetative characters of the trees—especially foliage and bark renewal—have been improved.

In view of the availability of high yielding planting material, interest is being taken in rejuvenation and replanting of old rubber areas, which show signs of marked decrease in yield or on which root disease is becoming the limiting factor in the life of the trees or the yield of latex.

Investigations in relation to estate factory practice have demonstrated the possibility of increasing the output of sheet rubber by the use of wide roll light machines and deep coagulating tanks.

On several estates an output equivalent to 1,200-1,300 lbs. of dry rubber per hour has been obtained with a light battery of three smooth roll and one marking machine compared with an average output of 400-500 lbs. per hour obtained in the best factories.

The handling of the coagulum from the coagulating tanks without preliminary hand rolling has been effected by means of suitable aluminium chutes.

An investigation of latex has resulted in the isolation of a lipin body which appears not only to be of importance in relation to rate of vulcanisation but to be closely related to the important variability in plasticity of plantation rubber.

Investigations on the presence of fine sand in latex and sheet rubber have demonstrated the importance of preliminary settling of latex and careful straining in "box" or similar strainers with vertical sieves.

A feature of the year has been the large number of enquiries for advice and assistance received by the Rubber Research Institute in respect of various defects in raw rubber.

Small Holdings.

Increasing interest has continued to centre on the production of rubber from small holdings. Data collected by the Statistical Division of the Department of Agriculture place the production on small holdings for the two years 1929—1930 at the following figures:

	1929.	1930.
Federated Malay States ...	110,282 tons ...	110,206 tons
Straits Settlements ...	— ...	38,770 „ approx.
Unfederated Malay States ...	— ...	66,113 „

It will thus be seen that the production from small holdings as yet shows no signs of diminishing. Considerable attention has been given to the question of bark consumption on small holdings and proposals put forward for under-

taking a regular survey in this respect. Preliminary observations conducted during the year appear to indicate that in the effort to obtain as large a yield as possible the rate of consumption on small holdings may be considerably outstripping the rate of bark renewal.

There is no question that many small holdings have been severely tapped, while the general upkeep has to some extent detriorated. In places a certain number of the poorer holdings have remained untapped for a number of months; on others tapping has only been discontinued temporarily during adverse weather conditions, during padi planting or harvesting operations, or during a period when the price of rubber was at its lowest.

Some owners of small holdings have dismissed their tappers and undertaken the work themselves. Many more have re-introduced the pernicious produce sharing system whereby the tapper receives as pay the larger share of the rubber obtained and, in consequence, extracts every ounce he can, regardless of damage to the trees. Where wages have been paid the rate given has perforce been the lowest possible.

Pests and Diseases of the Rubber Tree.

The most notable feature of the year was a severe outbreak of mildew disease of the leaf caused by the fungus *Oidium Heveae* in certain areas in south Negri Sembilan and Malacca.

This is attributed to the prolonged drought after the normal dry period during the wintering season in February-March. The trees, however, made a good recovery after the secondary leaf fall, which followed the normal leaf fall during February-March.

The fungus was identified in a number of districts later in the year and steps have been taken to deal with the situation if an outbreak occurs during 1931. An important observation is the fact that the fungus appears to be carried over from one season to another on the inflorescences of the tree.

As a result of the outbreak and the investigations conducted, the disease has been declared a Notifiable Disease under the Pests and Diseases Enactment and Ordinance in the Federated Malay States and Straits Settlements respectively.

Two sulphur dusters have also been purchased by the Rubber Research Institute for experimental work while close touch is being maintained with the control work being carried out in Java and Ceylon where the disease has been epidemic in character.

Although it is thought that the climatic conditions generally in Malaya are unfavourable to the outbreak and spread of this disease, this cannot be definitely stated at present, since the trees may become less immune to attacks.

An investigation of the incidence of root diseases—especially *Fomes pseudoferreus* and *Ustulina zonata* in rubber of different age classes—has been continued.

The importance of these diseases to the life of rubber estates is being realised on estates and control measures are becoming increasingly practised.

Somewhat severe outbreaks of Mouldy Rot occurred especially on small holdings during the wet season at the end of the year; measures to deal with this were undertaken.

Arrangements are being made for the investigation of proprietary and other fungicides for the treatment of this disease, since it has been realised that the present position is not altogether satisfactory.

No other fungus diseases call for special comment.

Damage by squirrels has been particularly noted on a few estates, not only on branches but also on the soft renewing bark on the tapping panel.

Scale insects (*Lecanium* species and *Pulvinaria* species) have also caused damage on two estates, chiefly owing to non-attention in the early stages.

An investigation carried out by the Pathological Division of the Rubber Research Institute has demonstrated the value of an asphalt cum kerosene or solar oil mixture as a wound cover or for application on pruned surfaces in budding and other operations.

Research Facilities.

Research work in relation to the rubber industry was continued by the Rubber Research Institute, the activities of which have been maintained at the full strength in spite of slump conditions. Appreciation of the work of the Institute is widespread in planting circles. Close liaison has been maintained by the Institute with the Department of Agriculture and the Department of Co-operation, the former covering all disease control work and propaganda among small holdings and the latter undertaking work in relation to improvement of manufacturing and marketing methods among small-holders.

Miscellaneous Article.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

Third Quarter, 1931.

The Weather.—Rainfall was generally above normal for July but below normal for August and September, except that Malacca experienced wet weather throughout the quarter and parts of Selangor and the Negri Sembilan during September.

Prices.—The following tabulated summary indicates the prices paid to the small-holders by local dealers as compared with both the average Singapore price for the month for standard sheet and the price quoted in Singapore and Penang by large dealers for small-holders' rubber at the end of the month. All quotations are given in Straits dollars and cents at the price per pikul (133⅓ lbs.) for ease of comparison.

	Singapore Standard sheet (Average)	Singapore for small holders rubber	Penang for small holders rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Pahang	Johore
					JULY						
Smoked sheet.	12.93	9.50	11.00	10.60-11	10-14	9-12.50	9-14	8-13	8-10.50	8.50-12.50	9-12.50
Unsmoked.		8.50	9.00	8-10.50	9-13	7-10.50	7-9.50	7-10.50	7-8	7-11.50	7-11
					AUGUST						
Smoked sheet.	9.73	7.50	9.00	8-9	8-12	7-10	5-10.50	6-9	7.50-9	7.25-11	6.40-10.5
Unsmoked.		6 00	7.00	-	6-11	6-7.50	5-7	5-8	6-7	6-9.20	6-9.25
					SEPTEMBER						
Smoked sheet.	10.13	8.50	9.00	6-8.30	8-11.60	7.50-11.50	6-11	6-10	8-9	7-9	6-11
Unsmoked.		7.00	7-7.50	4-6.50	7.50.9.25	6-8	5-7.50	5-8	6-7	5-8	6-10

In comparing the above figures it must be realised that the quotation for Singapore standard sheet is the average price for the month, whereas other quotations give the range of prices during the month and, except in the case of quotations for Singapore and Penang, the range of prices over a number of buying centres. In some such centres the price is regularly maintained at a higher level than at others. Thus, in Province Wellesley for September the range of prices in dollars per pikul for smoked sheet at four centres was,

Butterworth $8.40 to $11.60; Bukit Mertajam $10; Sungei Bakap $8 to $10; Dindings $8 to $9. The Butterworth price is always relatively high owing to a supply of comparatively high grade rubber, competition of buyers and nearness to Penang. Similarly, the Perak prices for September at ten centres were, Taiping $11.50; Krian $7.50; Batu Kurau $9.50; Selama $7.50 to $9; Kuala Kangsar $9 to $10; Tapah $7.50 to $8.50; Kinta $8 to $8.50; Tanjong Malim $9.25; Telok Anson $9.20 and Bagan Datoh $8.50.

It will be seen that the prices paid in many centres are higher than Penang and Singapore quotations for small-holders' rubber. In some instances, the higher prices quoted for small buying centres approximate closely to the highest quotation for Singapore Standard Sheet during the month. Recent investigations regarding prices indicate that the price paid by the local buyers in some centres for small-holders' rubber leaves little margin for profit if the product is to be sorted and re-sold as sheet in various grades at the prices quoted for those grades. At the moment there appears to be a better market for native rubber for re-milling than for re-sale as sheet after grading. A large proportion of the re-milled rubber is turned into blanket crepe for which there appears to be an increasing demand, and the miller appears to rely for his profit upon a large turnover rather than upon any great difference between the buying and selling price.

Tapping.—Reports of the cessation of tapping on further holdings have been received during the quarter. Thus, in the Negri Sembilan, the acreage of untapped holdings was estimated to total 5,000 acres in July, 5,700 acres in August and 6,000 acres at the end of September. In the case of holdings owned by Chinese and Chettiars the continued low price of the commodity is the cause and such holdings are likely to remain untapped indefinitely unless the price rises. With regard to Malay-owned lands, the stoppage is in most cases probably only temporary whilst owners are engaged on padi planting. In Malacca, where padi planting is practically completed, tapping on many holdings was reported to have re-commenced in September.

Reports are general from throughout Malaya of increasing numbers of cases of excessive tapping and bark removal where owners' only source of livelihood is rubber.

Judging from the returns so far to hand in connection with the bark consumption investigations, three inches is a usual width of bark removal during the course of a month, although cases of two inches occur as well as several cases of four and five inches and a few of six inches. There is considerable variation in length of the tapping cut in relation to tree circumference. Returns examined are not sufficiently numerous to provide more than an indication, so the figures given may need to be modified to some extent when more returns are available and they have received more critical examination than has yet been accorded.

Planting Distances.—Judging again from returns connected with the investigations mentioned, the most common planting distances would appear to be

12 feet by 12 feet and 15 feet by 15 feet. Limits so far recorded are 10 feet by 10 feet as the nearest and 20 feet by 20 feet as the widest distance. Here also further data may show that modification of figures will be necessary.

Grade of Rubber made.—For some time past there has been a tendency for the small-holder in many centres to neglect the manufacture of sheet rubber in favour of an article that requires much less preparation. This slab or lump rubber is crudely prepared and, on present accepted standards, is a low grade product. Compared with sheet it is imperfectly dried. In the Krian and Larut Districts of Perak its price per pikul was from $6 to $7 in July, $3 to $5 in August and $4 to $5.50 in September. At this price for an article of comparative high moisture content that demands little time or care in its preparation, the sale of slab or lump rubber is possibly a better economic proposition for many small-holders than the preparation of the higher priced sheet rubber. The demand for slab or lump rubber is connected, most probably, with the increased demand for rubber for re-milling into blanket crepe.

Diseases.—(a) *Mouldy Rot.* During the quarter it has become increasingly evident that the present economic position of the small-holder has made it impossible for the Department of Agricuture to insist upon the former standard of control of Mouldy Rot. Standard methods included cessation of tapping for a period of from three weeks to one month, whilst the recently tapped area was painted with an approved fungicide at ten-days intervals. Where an owner relies solely upon rubber for his livelihood it is often impossible to enforce the period of stoppage. Furthermore, many small-holders have not the money to buy sufficient quantities of the necessary fungicides to effect efficient control. Consequently, where these conditions obtain, efforts are directed towards minimising the damage to renewing bark by encouraging periodic painting with an approved fungicide.

(b) *Root Disease.* General observation of small holdings in Malaya inclines to the opinion that root diseases are less common and do much less damage on small holdings than on estate rubber and this opinion receives support from observations made by the Bark Recorder in charge of the bark consumption investigations. He reports that of the trees chosen for records in the selected holdings he has so far examined, there is a surprising sparsity of noticeable evidence of root diseases.

In only a very few cases has he noticed trees with visible signs of such diseases. As the method employed in these investigations is to mark off 100 consecutive trees in each of the holdings selected, his report indicates that root disease is probably a factor of little importance in small-holders' rubber. The Bark Recorder has had much practical experience on estates so his opinion is worthy of some attention. At the same time, his opinion is formed from above-ground observations only and not from detailed examination of the roots of trees on small holdings. A tree to tree inspection for root disease is the only method of obtaining exact information on the matter and this is a very expensive operation, so is impracticable of performance on a large scale.

Departmental.

FROM THE DISTRICTS.

The Weather.

Normal wet October weather obtained in Kedah and Province Wellesley. In Perak generally, although the month was fairly uniformly wet, the rainfall was below the October average, especially in the south of the State. Selangor's weather was showery and towards the end of the month very heavy showers fell in some inland localities, but rainfall throughout the State was below normal for the month. In Negri Sembilan and Malacca the weather was appreciably drier than for September and the same applies to West Pahang. On the east coast of Pahang cloudy weather with occasional showers was experienced.

Remarks on Crops.

Rubber.—The prices paid for small-holders' rubber by local dealers in dollars and cents per pikul* ranged as follows during the month; smoked sheet, $7.50 to $13.00; unsmoked sheet, $6.50 to $11.00; scrap, $2.00 to $6.00; lump, $3.00 to $7.00. The range quoted in Penang for small-holders' smoked sheet was $9.00 to $12.00 whilst the average price for the month for Singapore standard sheet was $11.75.

It will be noted that prices have ruled appreciably higher than for September and that the highest price paid in local centres for small-holders' smoked sheet is higher than the average price quoted for Singapore standard sheet. The reason appears to be that for a short period some speculative buying took place in certain centres on rumours of lower freight charges and that some form of restriction was to be introduced.

The area of untapped holdings in Negri Sembilan is reported to have increased to approximately 7,000 acres at the end of the month. On the other hand it is reported from Province Wellesley and Malacca that the increase in price resulted in the re-opening of a number of holdings that had been out of tapping for some time.

Padi.—Planting operations are now completed throughout Kedah, Province Wellesley, Perak, Negri Sembilan and Malacca, except for the Sungei Acheh area and in portions of the Central and South districts of Province Wellesley and parts of the Larut District of Perak. Exceptionally high tides caused considerable damage to the crop in certain coastal areas. Thus, in Kuala Kurau mukim of Krian, the inundation of sea water damaged approximately 30 acres of planted padi whilst in the Dindings and in Sabak sub-district of Selangor, practically all the plants in nurseries were destroyed. As the Sabak cultivators were without any supply of seed padi to re-sow their nurseries, 3,000 gantangs of seed of short season strains were supplied for the purpose from stocks held by the Department of Agriculture. A discolouration of leaves of padi in parts

* 1 picul = 133⅓ lbs.

of the Krian District was reported at the end of the month and the matter is under investigation. Apart from these occurrences, the crop is generally reported to be making satisfactory growth throughout the country.

Tobacco.—Continued interest is evinced in this crop. In Province Wellesley the area under tobacco is approximately 80 acres and in South Perak, 250 acres. Increased plantings are reported from Negri Sembilan, Selangor and Pahang. Some small-holders have planted up small areas of the Kedah type in the vicinity of Jerantut in Pahang. As expected would be the case on this volcanic soil, growth is reported to be exceptionally good. From specimens of diseased plants received for examination it would seem that the organism which causes Slime Disease, *Bacillus solanacearum*, is widely distributed in Malaya. During the month, the sale in Penang of cured Province Wellesley grown leaf amounted to approximately 120 pikuls. The price paid per pikul ranged from $15.00 to $35.00 according to quality. Prices in Perak South for locally grown and cured leaf ranged from $40.00 to $60.00 a pikul.

Agricultural Stations and Padi Test Plots.

Kedah.—The work of fencing and levelling proceeded satisfactorily at the Agricultural Station at Gajah Mati. The crop at the main rice station at Telok Chengai and at the Jitra Test Plot made satisfactory growth, whilst slower growth is reported on the poorer soil at Langgar Test Plot. Transplanting of the Rantau Panjang Test Plot was completed. At the Jitra and Langgar plots the fresh water crab (*Paratelphusa sexpunctata*) did some damage, necessitating control measures by means of baited earthenware pots, fish traps and bamboo joints. At Jitra the case worm, *Nymphula depunctalis*, put in an appearance.

Province Wellesley.—At Glugor Padi Test Station further plantings of six short season varieties were made. Three further very short season strains remain to be planted to complete the programme. At Bukit Merah the planting programme was completed. Drainage conditions at Glugor are considerably improved as the result of the recently erected additional culvert under the main road.

Perak. (*a*) *Agricultural Stations. Selama.*—Further progress has been made with clearing and levelling and in preparing foundations for the road and paths. Preliminary arrangements for fencing and buildings were completed.

Kuala Kangsar.—Seed of the Virginian tobacco, Joyner, is being collected and fresh nurseries of this crop have been sown. Green dressing crops have made a good start. A crop of groundnuts was harvested but gave a poor return. Coffee nurseries were laid down.

(*b*) *Padi Stations and Plots. Talang Station.*—Planting was completed and growth on the earlier planted areas is satisfactory. On the manurial experimental plots the plants that were manured in the nurseries have a decidedly much deeper green leaf than those differently treated. The banana area is being prepared for planting and suckers of the variety Embun have been ordered from Negri Sembilan.

Lenggong.—The earlier planted Seraup strains are making good growth and tillering freely. Trouble is still being experienced on certain deep portions of the station and much supplying is necessitated on such parts.

Bruas.—Growth is satisfactory, but differences in water levels are proving troublesome.

Bukit Gantang.—Planting commenced on the 10th. and was completed on the 21st. Water was scarce early in the month.

Kamunting.—Planting of the portion used for nurseries completed the planting programme. Water shortage caused some difficulty early in the month, but there was an adequate supply at the end of the month. The case worm, *Nymphula depunctalis* and the pentatomid bug, *Scotinophora coarctata,* (locally called Kutu Bruang or Bena Kura) caused some damage, which necessitated control measures. The manured strips stand out noticeably, both as regards deeper colour and increased vigour.

Selinsing.—Good growth was maintained, notwithstanding scarcity of water. A marked increase in growth and development is apparent in the manured plots.

Selangor. Cheras Agricultural Station.—Further progress was made with preliminary cultivation, lalang grass eradication and fence erection. The completion of two boundary drains on the north and south has resulted in much better drainage of the lower portions of the area. Work has commenced on the main access road and a contract for buildings has been made.

Kajang Test Plot.—The short season strain F.S.27 is ripening a good crop, but the two Radin varieties have not yet flowered.

Kuang Test Plot.—Here again the short season strains F.S. 27 and Radin Siak have come into bearing before the longer season Siam and Radin types. The pianggang, *Leptocorisa arcuta,* which damages the unripened grain, gave much trouble to the earliest ripening strains.

Negri Sembilan. Agricultural Stations. Seremban.—Pepper received a mulch and manure and shoots were layered to increase the stock. Sowings were made of maize and cloves.

Rembau.—All buildings are now roofed. Fencing has not progressed as rapidly as was anticipated. Work on roads was commenced and paths were planted with Carpet Grass.

Rembau Padi Test Plot.—Growth has been delayed by excess water due to heavy local rain. In the portion near the main road plants exhibit better growth than elsewhere on the plot.

Malacca. (a) Agricultural Stations. Sungei Udang.—Planting of rubber (Clone S.R. 9), Brazil nut, avocado pear, mangosteen, rambutan and lime took place, whilst pineapples, pepper and budded kapok are being planted. Materials for buildings have been collected on the land preparatory to erection.

Jasin.—Survey of the site is in hand.

(*b*) ***Padi Stations and Test Plots. Pulau Gadong.***—Nurseries of two Australian and four Italian short term varieties were sown. Weeding was in progress. His Excellency the Governor visited the station on the 22nd.

Alor Gajah.—The appearance of this Test Plot is excellent. The varieties Siam 29 and Nachin 10 have commenced to flower.

Pahang. (*a*) *Agricultural Stations.*—One plot of sweet potatoes was harvested and another two plots have been planted. Maize, groundnuts, soya beans and tobacco are making good growth.

Temerloh.—Felling, clearing and preliminary cultivation was completed Fencing posts have been erected and erection of buildings commenced.

Kuantan.—Erection of buildings was commenced.

Pekan.—Repair work on the cattle shed was completed and gates and signboards were erected. The dry land padi is making fair growth but weeds are very troublesome, necessitating frequent weeding.

(*b*) *Padi Test Plots. Dong.*—Planting was completed. Growth is vigorous and tillering exceptionally good. Work on a new store was commenced.

Temerloh.—Harvesting commenced with the strain F.S. 27 and the other varieties are flowering. The plants are somewhat uneven due, doubtless, to variation in depth of water.

Pekan.—F.S. 27 and Radin Siak have commenced to flower, but the crop is expected to be light owing to dry weather and consequent lack of water for the past month.

Singapore. Pineapple Station.—General routine work on the pineapples continued, such as weeding and labelling. The growth, though even, is very slow compared with plants on virgin land. The green dressing plants have shown some response to chemical manures and farmyard manures but no response to lime. The principal interest during the month centred around the Virginian tobacco trials. Further nurseries of the variety Hickory Prior were sown.

DEPARTMENTAL NOTES.

H. E. The Governor visits Malacca.

H. E. The Governor, accompanied by the Resident Councillor, Malacca, visited the Pulau Gadong Rice Experiment Station on 22nd October, 1931.

The Acting Director of Agriculture visits Perak.

The Acting Director of Agriculture (Mr. F. W. South) paid a visit of inspection to Agricultural Stations and Padi Test Plots in Perak from the 13th. to the 19th. October, 1931.

Copra Kilns.

Mr. F. C. Cooke, Assistant Chemist for Copra Research, visited Province Wellesley to advise a coconut estate on questions connected with the designing and working of Ceylon-type copra kilns.

Tobacco Cultivation.

Increasing interest has recently been shewn by Asiatics in the cultivation of tobacco, the stimulus probably being provided by the increase in duty on imported tobacco and the need felt of growing any crop which is likely to give an early cash return.

The market for the indifferent quality of leaf usually produced, however, is limited and there is evidence that prices will not long remain at their present high level.

An article on tobacco cultivation which has recently been published in the Vernacular journals of this Department was opportune, as a number of letters of enquiry from both Malay and Chinese for information on this crop have been received.

Tuba Root.

The Agricultural Chemist is engaged in the determination of the rotenone content of tuba root of various species. The results of this work will not be available for some time.

An investigation has also been commenced to ascertain the extent to which the ether extract of the root is affected by reason of insect attack on the stored tuba root.

Rural Lecture Caravan.

The tour in Perak North arranged for between September 1st. and 19th. could not be carried out wholly according to schedule as a breakdown to both dynamos unfortunately occurred at Lenggong on the 9th. The caravan was immediately despatched to Ipoh for repairs, but the incident necessitated

abandoning four of the centres arranged upon in the programme. Altogether fourteen instead of eighteen centres were visited. A performance was given before H. H. the Sultan of Perak at Kuala Kangsar on September 6th.

A further tour of the Lower Perak District was arranged for the period October 2nd. to 9th. inclusive. Here again dynamo trouble was experienced which necessitated giving up visits to three centres in the Bagan Datoh area. This was particularly unfortunate as a special lecture with exhibits had been prepared for this area for propaganda connected with coconuts and copra production. Since the return of the caravan to headquarters, a thorough overhaul of the engine and electric installation has been made and it has been decided to provide a separate self-contained generating plant that can be transported in the caravan, but which is sufficiently light to be capable of being carried for short distances by two or three men. It is expected that this will not only make for greater mechanical efficiency, but will also enable places to be reached some distance from a main road that cannot be served by the caravan itself. It should also make it possible to arrange tours by launch and so reach the population living on the banks of the larger rivers.

Leave.

Mr. J. N. Milsum, Assistant Agriculturist, has been granted 8 months and 16 days' leave on full pay with effect from the 3rd. October, 1931.

Mr. F. S. Banfield, Horticultural Assistant, returned from leave of absence on 15th. October, 1931.

Mr. A. Thompson, Acting Mycologist, returned from leave of absence on 29th. October, 1931.

Statistical.

MARKET PRICES.

October, 1931.

Rubber.—The average spot price of rubber smoked sheet equal to London standard in Singapore was 8.8 cents per lb. in October, as compared with an average of 7.6 cents in September. The highest price was 9¾ cents and the lowest 8 cents. The London average price was 2.9d per lb., as compared with 2.5d in September.

Palm Oil.—London states that, in common with most commodities, palm oil advanced in price on the change of the basis of sterling and up to £18.10.0 was paid for Malayan oil. Prices, however, have declined and the recent rise in price has been of little use to producers generally.

Copra.—The local price of copra has decidedly firmed during the month, the average Singapore price of Sundried being $4.95 per picul, with Mixed 49 cents lower. Average prices for September were: Sundried $4.04, Mixed $3.72 per picul. Copra cake has been steady at $2 per picul.

Coconut Oil.—Our Singapore correspondent states that the market for coconut oil has steadied slightly during October. Business was well established for the first half of the month, but afterwards was dull. The average wholesale export price for October was $9.50 per picul.

Gambier.—Block gambier has been steady at $12 per picul, while Cube No. 1 has advanced from $19.00 to $20.50 per picul, the average price for October being $19.90, compared to $17 in September.

Rice.—The average declared trade value of rice into Malaya during September was $4.15 per picul, as compared with $4.04 in August. The retail market prices in cents per gantang of No. 2 Siam rice in September were:—Singapore 31, Penang 32, Malacca 29, compared with 30, 31 and 28 cents respectively in August.

Arecanuts.—Average prices of Palambang were around the previous month's level, the average price for October being $4.55 per picul. Bila Whole improved slightly in price from the average of $4.16 per picul in September to $4.25 in October. For other grades, the average prices in October were as follows:—Sliced, $8.95 to $12.50; Split, $4.75 to $6.41; Red Whole $8.88 to $9.30—all per picul, the price within each range depending upon quality. Kelantan Split averaged $6.25, but being the end of the season, the import crop was very small and the quality inferior. Split and Whole arecanuts were in better demand for the Indian market at the end of the month.

Coffee.—Java Robusta prices have remained steady, the average for the month being $15.10 to $17 per picul, the price between these limits depending upon quality. Corresponding average prices for September were $15.31 to $16.44. The average price for Palambang coffee in October was $12.65 as compared with $11.69 in September.

Pineapples.—Prices have remained steady during the month. The canning season is now in full swing, but the demand appears to be moderate, buyers probably holding off for lower prices. The average prices in October were:—$1\frac{1}{2}$ lb. cubes, \$3.72; $1\frac{1}{2}$ lb. Sliced flat, \$3.43; Sliced tall, \$3.40 (nominal) all per case. Corresponding prices in September were:—\$3.50, \$3.27, \$3.31.

Tapioca.—Prices have been steady around the following average prices for October. Flake, fair, \$3.60; Pearl, seed, \$4.75; Pearl, medium, \$5.00 per picul. Corresponding average prices in September were:—\$3.41, \$4.47 and \$4.49.

Sago.—A fluctuating market with sellers inclined to hold out for fancy prices. Average Singapore prices in October were:—Pearl, small, fair, \$4.78; Flour, Sarawak, fair, \$2.36 per picul. Corresponding prices in September were \$4.44 and \$1.82 per picul.

Nutmegs and Mace.—Both quoted at nominal figures, the market being dull with but little demand. Average October prices in Singapore were:—Mace, Siouw \$70 and Amboina \$46.40 per picul. Nutmegs, 110 per lb., \$23.90 per picul; 80 per lb., \$35 per picul.

Pepper.—The market has shewn much fluctuation on account of varying demand and heavy arrivals. Average Singapore prices per picul in October were:—Singapore, Black, \$19.90, Singapore White, \$30.40; Muntok White, \$31.40. Corresponding prices in September were \$19.09, \$28.56 and \$29.44.

Cloves.—Nominal prices in Singapore have been quoted throughout the month. Average prices for the month were:—Zanzibar \$45 per picul; Amboina \$53.40 per picul, as compared with \$50 and \$60 for September.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in October and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd.; reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore, and a report on the coconut oil market by the Ho Hong Oil Mills, Singapore.

1 picul = $133\frac{1}{3}$ lbs. The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

September, 1931.

Malaya.—Total foreign imports of rice into Malaya for September, 1931 amounted to 56,856 tons, of which 50.9 per cent. were into Singapore, 19.4 per cent. into Penang, 5.1 per cent. into Malacca, 17.5 per cent. into the Federated Malay States and 7.1 per cent. into the Unfederated Malay States.

Of these imports, 53 per cent. were from Siam, 42 per cent. from Burma, 4 per cent. from French Indo-China and 1 per cent. from other countries.

The total foreign imports of rice into Malaya from January to September 1931, were 531,896 tons, net imports being 406,695 tons, or 41,771 tons less than for the corresponding period of 1930.

The total foreign exports of rice in September 1391 were 11,739 tons.

Stocks of padi and rice held by wholesale dealers and millers in the Straits Settlements and Federated Malay States at the end of August amounted to padi 8,744 tons and rice 43,066 tons.

It is estimated that the stocks of rice (converting padi at 62 per cent.) in the Federated Malay States, Straits Settlemens and Johore at the end of August amounted to 65,109 tons, as compared with 51,532 tons at the end of July.

Padi reports indicate that work for the new season 1931—2 is in hand in all padi areas.

India.—Total foreign exports of milled rice during January to August, 1931, were 1,556,000 tons, a decrease of 569,000 tons or 26.7 per cent. as compared with the corresponding period of 1930, and a decrease of 231,000 tons or 12.9 per cent. as compared with the corresponding period of the past six years.

Burma exports of rice and rice products (including exports to India) from January 1 to September 19, 1931, were 2,884,387 tons, an increase of 7,838 tons over the same period of 1930.

Japan.—Stocks of rice in Japan (Proper) on September 1, 1931, were 2,456,780 tons, a decrease of 1,209,703, or 33 per cent. as compared with the stocks on July 1, 1931.

It is reported that good weather in August has enabled plants to recover the losses in July and that the rice crop for the current season will be normal.

Formosa. It is reported that the first rice crop of 1931 yielded 508,876 tons for the 677,444 acres planted. This represents an increase of 20,449 tons over the record 1930 figures for the same crop. This satisfactory result was due to exceptionally favourable weather conditions, the increase of 17,284 acres in area planted and to increased marketing facilities in Japan for Formosan rice.

*** The following is an abstract of the General Rice Summary for September, 1931 compiled from various sources by the Registrar-General of Statistics, Straits Settlements.**

Siam.—Exports of rice from Bangkok from December 1930 to August 1931 were 919,514 tons, an increase of 86,078 tons or 10.3 per cent. as compared with the same period of the previous year and a decrease of 130,113 tons, or 12.4 per cent. as compared with the average of the same period of the last five years.

The area under padi in the seven exporting circles at the end of July 1931, was 2,171,672 acres, as compared with 2,771,652 acres at the same period of the previous year, or a decrease of 21.6 per cent.

The area under padi for the season 1930—31 in Siam (whole Kingdom) was 7,950,208 acres, an increase of 4.7 per cent. and the yield was 4,787,998 tons, an increase of 24.6 per cent. as compared with the previous season (1929—30).

Java, Madura and Netherlands East Indies.—At the end of August 1931, the area harvested amounted to 7,825,338 acres, a decrease of 1.7 per cent. as compared with the same period of 1930; the area damaged to 392,322 acres, an increase of 90.4 per cent. over the previous season; and the area standing to 974,617 acres, an increase of 1.5 per cent. as compared with the same period of 1930.

Imports into Java and Madura, January to August 1931, were 195,163 tons, compared with 204,468 for the same period of 1930. Imports into the Outer Provinces, January to July, 1931, were 197,422 tons as compared with 191,354 tons for the same period of 1930.

French Indo-China.—Entries of padi at the port of Cholon (January to September 30, 1931) were 893,164 metric tons, a decrease of 122,469 metric tons or 12.1 per cent. over the same period of the previous year.

Exports of rice from Saigon (January to September 30, 1931) were 786,533 metric tons, a decrease of 127,407 metric tons, or 13.9 per cent. as compared with the same period of the previous year.

Ceylon.—Imports January to August, 1931, inclusive were 293,374 tons, a decrease of 22,413 tons or 7.1 per cent. as compared with the same period of the previous year.

Of the total imports in 1931, 16.8 per cent. were from British India, 75 per cent. from Burma, 2 per cent. from the Straits Settlements and 8 per cent. from Cochin-China and Siam.

Europe.—For the period January 1st to September 17, 1931, 883,913 tons of rice were shipped, compared with 604,366 tons for the same period of 1930 or an increase of 46.3 per cent.

Of the total shipments, 63.9 per cent. were from Rangoon, 24.8 per cent. from Saigon, 5.9 per cent. from Siam, 2.7 per cent. from Japan and 2.7 per cent. from Bengal.

To the Levant, period January 1st to August 19, 1931, 45,890 tons were shipped, an increase of 30,452 tons or 198.4 per cent. as compared with the same period of 1930.

To the West Indies and America, period January 1st to August 13, 1931, were shipped 113,069 tons, a decrease of 23.5 per cent. as compared with the same period of the previous year.

MALAYAN AGRICULTURAL EXPORTS.

August, 1931.

Product	Net Export in Tons.				
	1930	Jan. 1—July 31, 1930	Jan. 1—July 31, 1931	August 1930	August 1931
Coconut, fresh ...	10,475	6,051	4,721	807	605
Copra ...	102,014	46,530	47,042	10,029	13,732
Coconut oil ...	9,475	5.668	5,939	651	701
Palm Oil ...	3,211	1,594	2,033	149	281
Palm Kernels ...	485	235	301	31	23
Pineapple, canned ...	57,698	39,423	41,029	5,305	4,305
Tapioca ...	31,195	17,944	17,272	3,176	2,516
Arecanuts ...	23,254	15,386	12,595	1,901	454
Tuba Roots ...	55½	—	41	—	5 ~~106~~

AREA OF MATURE RUBBER UNTAPPED IN JULY AND AUGUST IN JOHORE AND KEDAH.

(Estates of 100 acres and over)

State.	Area untapped (acres)				Total area untapped (b)	
	Estates which have entirely ceased tapping.		Estates which have partly ceased tapping.			
	July	August	July	August	July	August
Johore ...	23,464	23,445	49,583	49,164	73,047	72,609
Kedah ...	(a) 4,158		(a) 9,196		(a) 13,354	

(*a*) Rubber land owned by Registered Companies only. Reports from Kedah are received quarterly only. The Kedah figures given above are those reported at the end of June.

(*b*) Areas rested due to rotational tapping system are not included in the above table. The figures of areas untapped owing to rotational tapping system were for Kedah at the end of June 9,072 acres; Johore, end of July 30,161 and end of August 31,182 acres.

RUBBER AREAS UNTAPPED IN AUGUST AND SEPTEMBER 1931 IN THE FEDERATED MALAY STATES AND STRAITS SETTLEMENTS.

(Estates of 100 acres and over)

State or Territory.	AREA UNTAPPED (ACRES)				Total area untapped *	
	Estates which have entirely ceased tapping.		Estates which have partly ceased tapping.			
	August	September	August	September	August	September
Perak ...	8,264	8.483	28,178	28,532	36,442	37,015
Selangor ...	13,219	13.382	41,594	40,372	54,813	53,754
Negri Sembilan ...	15,906	15,051	22,573	23.551	38,479	38,602
Pahang ...	6,370	6.323	4,811	5,000	11,181	11,323
Total F.M.S. ...	43,759	43,239	97,156	97,455	140,915	140,694
Province Wellesley ...	3,056	3,166	7,723	7,720	10,779	10,886
Dindings ...	237	237	1,694	1.701	1,931	1,938
Malacca ...	4,650	4,862	18,549	17.833	23,199	22,695
Penang Island ...	747	747	165	150	912	897
Singapore Island ...	9,416	10,004	5,477	5.315	14,893	15,319
Total S.S. ...	18,106	19,016	33,608	32,719	51,714	51,735
Total F.M.S. & S.S. ...	61,865	62,255	130,764	130,174	192,629	192,429

Rubber areas rested due to rotational tapping system were as follows :—

	August	September
F.M.S. ...	37,297	39,650
S.S. ...	12,203	11,666
Total ...	49,500	51,316

* Not including areas untapped owing to rotational tapping system.

MALAYA RUBBER STATISTICS — TABLE I

Stocks, Production, Imports and Exports of Rubber, including Latex, Concentrated Latex and Revertex, for the month of September, 1931, in Dry Tons.

Territory	Stocks at beginning of month 1: Ports	Dealers	Estates of 100 acres and over	Production by Estates of 100 acres and over: During the month	during the year 1931	Production by Estates of less than 100 acres (estimated) 2: during the month	during the year 1931	Imports during the month: Foreign	From Malay States	Imports during the year 1931: Foreign	From Malay States	Exports (including re-exports) during the month: Foreign	Local	Exports during the year 1931: Foreign	Local	Stocks at end of month: Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Malay States :—																		
Federated Malay States	...	13,748	14,731	11,995	104,789	9,687	77,445	Nil	Nil	Nil	26	14,649	9,989	118,056	66,259	...	12,035	13,500
Johore	...	2,326	3,977	3,551	31,772	3,151	34,046	Nil	1	Nil	19	906	5,983	7,136	59,428	...	2,356	3,761
Kedah	...	454	2,356	2,244	18,915	1,026	9,337	Nil	Nil	Nil	Nil	577	2,833	5,626	23,005	...	450	2,220
Perlis	...	17	4	4	60	10	91	Nil	Nil	Nil	Nil	Nil	7	Nil	144	...	22	6
Kelantan ...	...	115	189	137	1,575	242	3,345	26	Nil	43	Nil	68	438	612	4,512	...	160	93
Trengganu ...	..	55	50	122	920	61	460	Nil	Nil	Nil	Nil	Nil	183	Nil	1,380	..	55	50
Total Malay States	...	16,751	21,307	18,102	158,031	14,177	124,724	26	1	43	45	16,200	19,433	131,432	154,728	...	15,078	19,630
Straits Settlements																		
Malacca ...	...	3,119	1,561	1,375	11,197			Nil		Nil		3,922		39,688		...	2,955	1,480
Province Wellesley	...	142	558	499	4,144			Nil		Nil						...	122	512
Dindings ...	...	114	141	97	857	(2) 2,416	(2) 18,316	Nil	19,471	Nil	155101	5,856	Nil	54,439	Nil	...	93	125
Penang	730	4,822	8	7	67			215		5,379						1,824	2,927	7
Singapore ...	4,887	34,196	280	159	1,592			6,614		71,727		18,358		164,367		5,833	32,314	282
Total Straits Settlements	5,617	42,393	2,548	2,137	17,857	2,416	18,316	6,829	19,47	77,106	155,101	28,136	Nil	258,494	Nil	7,657	38,411	2,406
Total Malaya	5,617	59,144	23,855	20,240	175,888	16,593	143,040	6,855	19,472	77,149	155,146	44,336	19,433	389,926	154,728	7,657	53,489	22,036

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
Dry Rubber	9,589	30,238	2,677	2,952	937	46,393
Wet Rubber	2,446	2,076	250	218	1,419	6,409
Total ...	12,035	32,314	2,927	3,170	2,356	52,802

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	28,479	253763
Penang ...	9,677	88,994
Port Swettenham.	6,053	43,761
Malacca ...	127	3,408
Malaya ...	44,336	389926

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	37,222	312225
Malaya ...	37,222	312225

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A]—[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st October, 1931.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER 1931.

Locality	Air Temperature in degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total		Most in a day: Amt.	Number of days: Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	89.4	72.0	80.7	95	69	82	75	84.1	84.9	9.68	245.9	1.54	18	17		1		163.15	5.44	
Bukit Jeram, Selangor ...	88.3	72.7	80.5	92	70	81	75	84.4	86.6	6.28	159.5	1.01	20	16				180.15	6.01	50
Sitiawan, Perak ...	89.5	72.7	81.1	93	70	83	75	84.7	85.0	7.88	200.2	1.37	17	13	1	1		180.20	6.01	
Kroh, Perak ...	85.1	69.9	77.5	91	67	79	73	82.3	82.9	4.10	104.1	1.12	22	15		1		158.60	5.29	
Temerloh, Pahang ...	89.4	72.5	80.9	94	70	84	75	84.9	86.3	12.58	319.5	3.95	18	13	5	7		167.20	5.57	
Kuala Lipis, Pahang ...	88.6	71.5	80.1	92	69	81	75	83.6	84.5	11.79	299.5	2.57	17	13	14	21	1	140.80	4.69	
Kuala Pahang, Pahang ...	87.0	74.2	80.6	90	72	84	77	84.6	86.4	6.32	160.5	2.58	14	9	1			178.50	5.95	
Mount Faber, Singapore ...	87.4	74.9	81.1	91	70	80	79	82.9	83.7	9.79	248.7	2.61	21	19	1			160.70	5.36	44
Butterworth, Province Wellesley ...	87.4	74.2	80.8	92	72	84	76	84.9	85.2	5.68	144.3	1.17	21	17			1	179.30	5.98	
Bukit China, Malacca ...	84.8	73.7	79.3	88	71	81	76	83.1	83.9	17.20	436.9	3.51	20	18	7			172.80	5.76	48
Kluang, Johore ...	87.4	71.6	79.5	92	69	80	73	82.4	83.1	9.92	252.0	2.38	19	14	2	6		134.40	4.48	37
Bukit Lalang, Mersing, Johore	88.6	72.0	80.3	92	70	84	74	82.9	83.0	5.63	143.0	0.96	16	13				167.80	5.59	46
Alor Star, Kedah ...	86.6	74.1	80.3	90	70	82	77	86.2	86.5	8.11	206.0	1.48	22	19			1	168.75	5.62	
Kota Bahru, Kelantan ...	89.2	73.6	81.4	92	72	81	75	85.2	85.9	8.18	207.8	1.57	17	16	1	1		189.70	6.32	51
Kuala Trengganu, Trengganu	88.4	72.7	80.5	91	70	85	75	84.8	85.9	8.44	214.4	1.84	18	11	2			189.75	6.33	52
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.2	59.1	65.1	76	56	64	61			8.45	214.6	1.47	21	18		3	1	124.75	4.16	34
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.1	57.2	64.7	78	52	66	62	70.3	70.3	8.77	222.8	2.21	22	18	1	7		113.95	3.80	31
Fraser's Hill, Pahang 4268 ft.	73.9	62.1	68.0	77	59	67	64	71.4	71.9	4.53	115.1	0.68	22	15	5	18		144.80	4.83	40

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE

Malayan Agricultural Journal.

DECEMBER, 1931.

EDITORIAL

Bulk Shipment of Palm Oil.

During the early stage of the development of the palm oil industry in Malaya, when the area in bearing was small, the amount of palm oil produced was insufficient to render feasible its export in bulk.

Producers were compelled to import barrels which were assembled on the estates and rendered suitable for containing palm oil.

The very considerable expense entailed by the import of barrels directed attention to the possibility of employing Malayan timber for this purpose. One oil palm estate, to our knowledge, experimented in this direction for some time but eventually abandoned the idea chiefly, it is thought, on account of the difficulty in obtaining sufficient quantities of more suitable timbers and to the local lack of knowledge coopering.

The satisfactory prices obtained for palm oil, however, rendered the export of palm oil in imported barrels remunerative, although planters looked forward to the time when bulk shipments would become possible.

During the past two or three years the export of palm oil from Malaya has steadily increased. In 1929 it amounted to 1,831 tons, in 1930 to 3,211 tons, while it is expected that the exports of 1931 will approach 4,000 tons.

Our Dutch friends in Sumatra, possessed as they are with a larger area of oil palms in bearing, (the figures at the end of 1930 were 74,000 acres in bearing and exports for the year of 47,258 tons of oil), have already inaugurated bulk shipping of their oil and it occurs to us that it is high time that the Malayan palm oil interests should consider this subject.

In the present number, an account is given of the first bulk shipment of palm oil from Malaya. This was undertaken by a firm with very extensive oil palm interests in Malaya, so that the amount of their present produce evidently justifies their action. But there are in Malaya, a number of estates of less area that individually will never be in a position to ship oil palm in bulk, but should derive considerable benefits by the innauguration of a service in which they with others could participate.

The article in this number, which could not have been written without the facilities which the Socfin Co. Ltd. offered to the author, may not only direct attention to the importance of this subject, but may serve as a guide to the method by which bulk shipments of oil from this country may be systematised.

Padi Experiments.

Investigations on padi problems are assisted very little by the work of a similar nature with other crops, by reason of the fact that padi is grown in water, and necessarily adapts itself to this habitat. It is to be expected, therefore, that its behavior to variations in conditions finds no parallel in other crops. Research on the problems of cultivation, planting methods and manuring for instance, can find but little assistance from similar work on dry-land crops, while pre-conceived ideas on the subject are apt to prove most misleading.

In Malaya, padi experiments and the application of the results have engaged the attention of the Department of Agriculture almost since its inception and from the investigators, through both the European and Asiatic field Staff, the results of the work are being demonstrated and made available to the individual padi planters throughout the country.

The progress of the work may be visualised from the summary of the experiments which is included in this *Journal.*

Although valuable results have been obtained from these investigations it is not contended that finality has been reached. The solution of one problem frequently reveals further problems to be solved. Manurials experiments are being conducted on lines reorganised in the light of previous unsuccessful experiments, breeding work is in its infancy and the effect of soil and water gases, of bacteria and protozoa is as yet but imperfectly understood although the importance of each becomes increasingly evident.

The work of minimising losses of crops by reason of stem-borer attacks is a specialised problem of which mention is made in this article. A complete account of research work in this direction will be the subject of a special report to be published at a later date.

The Preparation of Organic manure.

The increasing importance of stock raising in Malaya gives point to the article on another page on investigations on the preparation of organic manures. The object of this work is rapidly to break down waste organic matter, such as grass cuttings, by the admixture of farmyard manure. The latter inoculates the grass with micro-organisms capable of decomposing the grass cuttings or other organic matter and so rendering it of greater utility for manurial purposes.

These preliminary experiments shew that this breaking down process is capable of achievement within seven weeks. The writer points out that the usefulness of the resultant material is intricately bound up with content, assimilation, conservation and loss of nitrogen and the chemical constitution of the original materials.

Cultivation of Cloves.

The article on this subject included in this number, records the results obtained at the Government Experimental Plantation, Serdang. The evidence brought forward refutes the usual assertion that cloves will only flourish within sound of the sea. In the past, Malaya has produced a quality of cloves second to none in the world, and there appears to be no good reason why the country should not be able to regain her supremacy in this respect.

The times are, perhaps, not advantageous for inaugurating a large industry in cloves, and at the best of times the market for this commodity is easily overloaded. On the other hand, there is no reason why this crop should not be included in mixed plantations and be more generally planted by those who have small areas of suitable land at present undeveloped.

Ourselves.

With the present number we conclude the nineteenth volume of *The Malayan Agricultural Journal,* which constitutes the second year of publication in its present form.

Although the circulation of this *Journal* is steadily increasing and its influence becoming more widely recognised, it is to be regretted that there are still a large number of planters in Malaya who do not read the *Journal*. It has been stated too, that in some cases, those responsible for the finances of estates do not allow the small annual charge of $5 to be put through the estate accounts. We regard this as a retrograde policy, for it appears to us increasingly important in times of depression that the planter shall be conversant with the progress of science as applied to his industry.

The Department of Agriculture is the servant of the public and in particular, of the agriculturist. The *Journal* is designed to bring the Department more closely in touch with the agriculturists which it is intended to serve. It is hoped that Agency firms and Directors of Companies will assist this Department by the provision of these publications to the estates in which they are interested.

Original Articles.

BULK SHIPMENT OF MALAYAN PALM OIL

BY

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

A further stage in the oil palm industry of Malaya was reached on October 18th 1931 when the first bulk shipment of palm oil, amounting to approximately 102 tons, was made from Kuala Selangor by the Straits Steamship, s.s. "Krian," *en route* to Belawan, a second shipment of approximately the same amount being made a week later.

This development is due to the initiative of the Socfin Co. Ltd. who, as the pioneers of bulk shipment in Sumatra, have now decided to extend this method to their oil palm estates in Malaya.

Since the output from their estates in this country is, however, at present insufficient to warrant the erection of the necessary installation and allow of loading direct into ocean-going steamers, arrangements have been made with the Straits Steamship Co. to transport the oil to Belawan, where the Socfin Co. Ltd. have a large tank installation and the oil can be bulked with other palm oil of similar quality from their Sumatran estates.

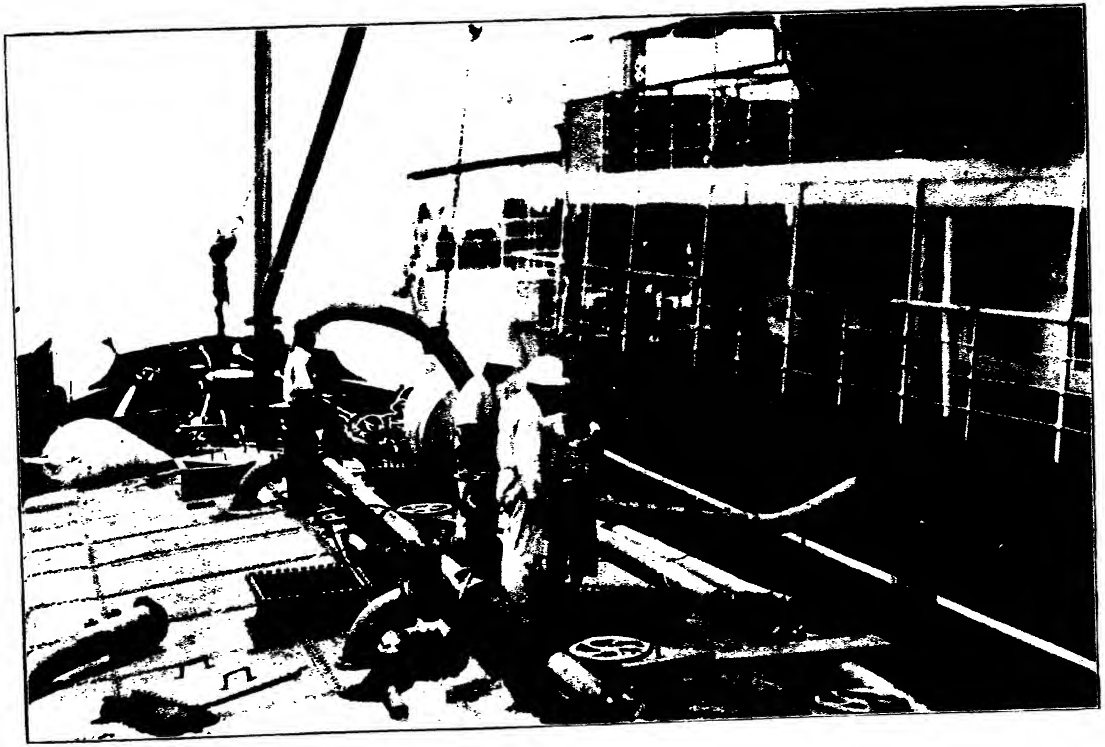
The adoption of such a procedure has enabled the Company to overcome the great difficulty now encountered when commencing the bulk shipment of oil, namely that buyers are either reluctant to accept separate consignments of less than 800 tons; or in the case of smaller consignments 400 or 500 tons, offer a price less than the prevailing market quotation, consequent upon the extra trouble involved in dealing with a relatively small shipment.

It must be realised, however, that the present arrangement is only temporary as the Socfin Co. Ltd. contemplates, probably in two or three years time, the erection of a large storage installation at one of the Malayan ports, loading of the oil being made then direct into the ocean-going steamer.

The Straits Steamship Co. have therefore installed in one of their ships, s.s. "Krian," storage tanks with the requisite pumping installation and the present arrangement is that this ship, which is on the Penang—Telok Anson run, calls at Kuala Selangor for palm oil, when there is sufficient to warrant shipment.

On the occasion referred to above, the oil came from Sungei Tinggi Estate, situated some 40 miles by river from Kuala Selangor, and three transhipments were therefore involved on account of the fact that only shallow draught barges can be used for the river journey.

In spite, however, of the relatively small amount being shipped and the fact that some of the present arrangements are also only temporary, it is thought



Pumping Palm Oil from Lighter to Ship.

that a general description of the method will be of interest, especially as it is hoped that with the steady increase in the output of the oil from the country more estates will decide to ship in this manner.

Method of Shipment.

The purified oil from the De Laval separator is delivered into a tank waggon, having a capacity of 1½ tons. The waggon is mounted on rails and pushed from the factory to the river bank, a distance of approximately ¾ mile, where the storage tank is erected. The waggon is connected to the tank with a length of flexible hose and the oil transferred by means of a hand-operated pump.

The capacity of the storage tank is approximately 100 tons. Such a relatively large tank was considered necessary in view of the fact that at various times in the year there may be insufficient water in the river to permit of the shallow draught barges making regular trips between the estate and the loading station for the lighter, and it is essential therefore to have a reserve of storage accommodation for the oil at the factory.

It may be mentioned here that the present method of transporting the oil from the estate factory by tank waggon is temporary; later it is hoped to install a pipe line direct to the storage tank.

The latter is provided with closed steam coils for heating the oil, if necessary, when delivering to the river barges, which come alongside and into which the oil is fed by gravity.

The river barges are fitted with two tanks, each having a capacity of 8 tons, making a load of 16 tons of oil per barge. The latter when loaded are towed down the river to Kuala Selangor, where the lighter is at present moored, the distance from the estate being, as mentioned previously, approximately 40 miles.

The tanks on the river barges are fitted with hand operating pumps capable of delivering 5 tons of oil per hour, the oil being pumped direct into one of the tanks on the lighter. A closed steam coil, which can be lowered into the tank, is available, if necessary for heating the oil. So far, however, no difficulty has been experienced in transferring the oil.

The total tank capacity of the lighter is approximately 230 tons, divided between six tanks, two forward, each of 30 tons, two amidships, each of 50 tons and two aft, each of 35 tons.

A donkey boiler, capable of maintaining a steam-pressure of 70 lbs., is fitted aft to provide the necessary steam for heating the oil and pumping. Each tank is fitted with a closed steam coil for heating purposes, while live steam is also available for cleaning the tanks when necessary. A 6 inch pipe is fitted for pumping the oil, which can be delivered at the rate of 65 tons per hour. Each tank is also provided with a separate valve to connect with the main pipe line.

The lighter is at present used as a storage tank and when sufficient oil has accumulated to warrant shipment, the lighter is towed out and moored alongside the s.s. "Krian," which anchors at sea about 2½ miles beyond the bar off Kuala Selangor.

The tank capacity of this ship is approximately 102 tons, divided between four tanks, two of the tanks each having a capacity of 40 tons, the other two each of 11 tons. The pumping installation on board comprises both suction and delivery, this dual arrangement facilitating considerably in the even filling of tanks, while the suction arrangement is especially useful for removing all oil from the pipe line on the completion of pumping.

The pipe line on the lighter is connected by means of 6 inch flexible hose with the installation on the ship and the oil which has previously been heated to approximately 110°F. is pumped from the lighter into the ship's tanks. When the level of oil in a tank is within one foot of the top it has been found advisable to change over from the pump on the lighter to the suction pump on the ship. This change enables a better control of oil at the finish, avoiding overflow with consequent wastage of oil.

The s.s. "Krian" conveys the oil to Belawan, where it is pumped into one of the 530 ton tanks of the installation and stored until sufficient has accumulated to warrant shipment by an ocean-going steamer.

At present the greater proportion of the oil shipped in bulk from Sumatra is imported into the United States of America, although it is understood that some of the larger European ports dealing in palm oil, notably Liverpool, are contemplating the erection of the necessary plant to deal with bulk shipments of oil on arrival.

Remarks and Conclusions.

Apart from the question of the most economical method of handling the oil from the factory to the ocean-going steamer, shipment in bulk also raises questions regarding the bulk measurement of oil of different acidities at varying degrees of temperature. Determination of the viscosity of the oil at varying temperatures must also be made, so that the best temperature for pumping can be ascertained having regard both to the rate of flow of oil and the necessity for avoiding heating of the oil to a temperature that may affect its quality. Work on these lines is being initiated.

The writer, who was present on the first occasion of shipping the oil, is indebted to Mr. I. Sibiriakoff of Sungei Tinggi Estate, who was in charge of the shipment of the oil, for most of the details in the description of the method of shipment.

THE EXPERIMENTAL CULTIVATION OF CLOVES.

BY

J. N. Milsum and J. L. Greig,

Assistant Agriculturists.

Introductory.

In a previous article the history, cultivation, and preparation for market of cloves in Penang and Province Wellesley was published (*Malayan Agricultural Journal,* Vol. XIX, page 4). In the present paper, it is proposed to record the results obtained with this spice crop at the Experimental Plantation, Serdang, Selangor, since the growth of the trees and yields have so far been very satisfactory.

It is generally considered that the clove tree (*Eugenia caryophyllata,* Thunb) will not thrive at any great distance from the sea. Ridley refers to this and states that clove trees in Penang obstructed from the sea-air by the configuration of the surrounding land, soon became badly affected with the "red-spot" disease (*Cephaleurus mycoidea,* Karsten) and subsequently died (*Spices,* 1912, page 173). The Experimental Plantation, Serdang, is approximately 25 miles from the Kuala Langat coast, which is the nearest open sea. It is, therefore, a matter of considerable interest to ascertain whether the present efforts to grow cloves so far inland will continue to be successful as the trees mature.

Propagation.

The usual method of propagating cloves is by sowing the seeds in shaded beds of prepared soil. At Serdang, success is obtained by sowing the freshly gathered fruit in boxes containing well-drained soil under heavy shade.

As in generally known, the cloves of commerce consist of the unopened flower buds of the clove tree. After flowering, the lower part of the flower together with the calyx swells and develops into a fleshy, one-seeded drupe, purple in colour and about 1 inch long. The period between the opening of the flower and ripening of the fruit is about 2½ months.

The fruits are spaced about one inch apart and pressed half an inch into the soil in a horizontal position. Germination takes place in one month from sowing and, provided the fruits have not become damaged by heating, 75 per cent. germination or more is commonly obtained. When the seedlings have two to three pairs of leaves they are carefully lifted from the seed boxes and transplanted into bamboo pots. The soil employed contains a large proportion of humus with the addition of sharp sand to ensure adequate drainage. The bamboo pots containing the seedlings are then placed on a firm surface under the shade of 'ataps' which are raised five feet from the ground to allow for watering. As the seedlings age, the shade is partially removed with the object of gradually

hardening off the young plants preparatory to planting in the field. Considerable care is necessary in watering as the clove tree is intolerant of excessive soil moisture during all stages of its growth. Should drainage be inadequate the seedlings lose their leaves and cease growing. With suitable treatment, the young plants attain a height of six inches within six to eight months from germination, and carry about ten pairs of leaves. The seedlings are then ready for planting in the field.

It may be mentioned here that investigations are now being undertaken to determine whether it is possible to propagate the clove tree by layering the lower branches. In addition, several indigenous species of Eugenia have been established, but so far, attempts to graft or bud scions on to the wild stock have proved unsuccessful.

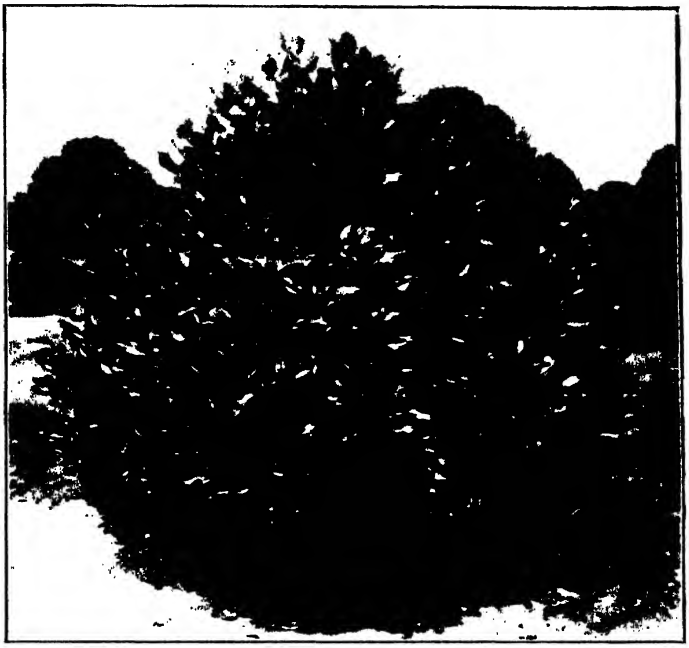
Planting.

The planting distance adopted is 20 feet by 20 feet triangular, allowing 124 trees per acre. In order to encourage the plants to make rapid growth and become established early, holes 2 feet by 2 feet square and 2 feet deep are dug. The sub-soil is removed and replaced by a mixture of well-rotted cattle manure, or other organic matter, and surface soil. After planting, the seedlings are shaded with jungle herbage placed securely round the plant. The most satisfactory planting season is October/November, which avoids the possibility of the plants receiving any check owing to drought. Even with the greatest care, considerable difficulty is experienced in establishing a complete stand of trees and consequently frequent supplying is necessary. During the short wet season, culminating in April, the planted area should be examined and all vacancies supplied with further seedlings.

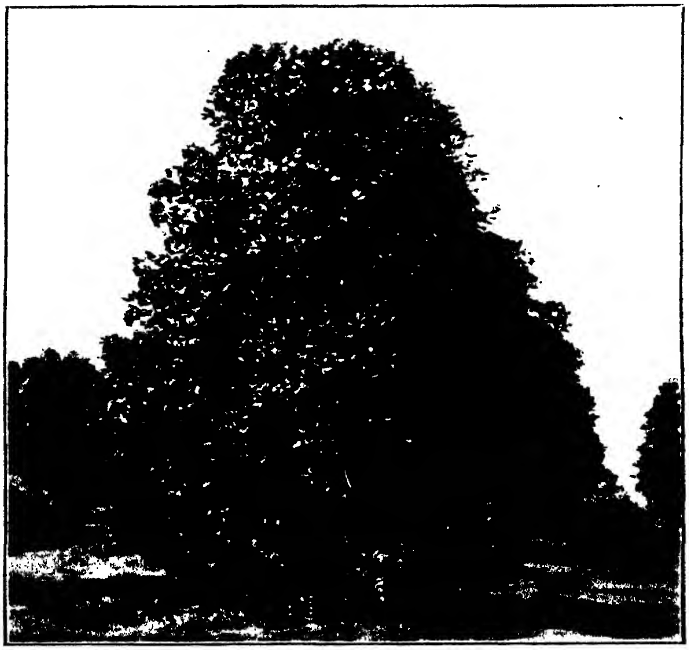
Cultivation.

At Serdang, the original area was planted with cloves in March, 1923 and was about 4½ acres in extent situated on the lower slope of a hill-side facing east. The soil belongs to the quartzite type being a yellow clay loam with some underlying laterite. As the silt-pitting system was found to be inadequate, contour bunds were dug in 1929-30. Subsequently, a further 3 acres were planted in October, 1930. Trenches 2 feet by 2 feet were dug along the contours with 2 foot stops every 30 feet, the spoil being placed on the lower side of the pit. In order to bind the bunds together the soil was first beaten down and then cuttings of vetiver grass, *Vetiveria odorata,* were planted along the top of the bunds 1 foot apart. Vetiver grass is to be recommended for this purpose since it does not spread laterally by means of stolons or runners and so get out of hand, while its vigorous root system tends to bind the soil.

Owing to the fact that the clove tree tends to form a mat of roots just below the surface of the soil, experience has caused two points to emerge. Firstly, competition from vegetation such as cover crops or weeds in the immediate vicinity of the bush is not desirable; secondly, root wounding or dis-



Clove tree 2 years old
Height 5 feet.



Mature Clove tree 8½ years old
Height 16 feet.

turbance during weeding operations is not tolerated. It is usual in Penang to cultivate the clove tree exposed to full sunlight. In Zanzibar, a light shade obtained by planting *Adenanthcra pavonina,* a small leguminous tree, is commonly employed. With the object of obtaining information on this point, half of the area under cloves at Serdang was interplanted with *Adenanthera pavonina.* The shade trees were interplanted between the rows of cloves at a distance of 20 feet by 20 feet. As far as can be ascertained at present the light shade appears beneficial although no improvement in yield of cloves is evident.

The importance of manuring the clove tree has been stressed by previous writers and experience at Serdang bears out fully this recommendation. Individual treatment of trees is necessary rather than sterotyped treatment of the planted area.

Young bushes respond well to an annual application of ammonia dug into the soil in a circular trench sufficiently far from the tree not to disturb the roots. At Serdang, a dressing of 3 ounces of this fertiliser per tree has resulted in considerably increased growth when compared with bushes receiving no manure. Cattle manure, or other well-rotted organic refuse, may be applied with advantage as the trees mature. The organic matter employed should in all instances be dug into the soil some distance away from the main surface roots of the trees.

Growth.

Measurements of the annual growth of twenty clove trees planted during March, 1923 have been taken since January, 1928 and the following figures show the annual rate of growth for the period 1928—1931 :—

Year.	*Height.*	*Spread.*
1928	8 ft. 0 ins.	5 ft. 10 ins.
1929	9 ft. 11 ins.	7 ft. 2 ins.
1930	14 ft. 7 ins.	10 ft. 6 ins.
1931	15 ft. 6 ins.	11 ft. 9 ins.

In June, 1931 these trees were examined and the average girth of the trunk one foot above ground level was found to be 1 foot 5 inches.

Yields.

The period between planting and flowering was from March, 1923 till June, 1927. A small crop was harvested during 1928 although insufficient to warrant yields being taken.

During the year 1930, the individual yields of 20 trees including the green weight of the fresh cloves and their residual weight when dry have been recorded. Cropping takes place from January to August with the heaviest yield during May and June. The following crop was harvested from 20 trees during 1930 :—

Weight of Green Cloves.	*Dried Cloves.*
230 lbs.	68 lbs.

This given an average yield per tree of 3.4 lbs. of dry cloves for the year. Allowing 124 trees per acre and 70 per cent. of these in bearing, a yield of about 310 lbs. of dry cloves per acre from seven-year-old trees may be obtained. According to Ridley (*Spices* l.c.) the average yield for mature trees in Penang was 5 lbs. of dry cloves per annum. The trees at Serdang are as yet comparatively young and should be capable of higher yields as they mature.

The freshly collected cloves are dried in the sun on a concrete barbacue for seven days. In order to ascertain the loss of weight on drying, four samples of green cloves consisting of 200 each were weighed immediately after harvesting, dried on the concrete barbacue for seven days and again weighed. The following table records the results obtained :—

Sample.	*Green Weight.*	*Dry Weight.*	*Percentage Dry Weight.*
200 cloves.	61 grams	18 grams	29.50 per cent.
200 ,,	59 ,,	17 ,,	28.85 ,,
200 ,,	58 ,,	17 ,,	29.30 ,,
200 ,,	61 ,,	18 ,,	29.50 ,,
Average.	59.8 ,,	17.5 ,,	29.29 ,,

It will be seen, therefore, that a loss of weight of about 70 per cent. results upon drying.

Market Prices.

The average market price at Singapore for both Amboina and Zanzibar cloves for the first half of the year 1931 was well over $50/- (Straits currency) per picul. (1 picul = 133⅓ lbs.) Recently, prices have declined, the market at Singapore for September, 1931 being quoted as Amboina $48/- and Zanzibar $43/- per picul, respectively. Produce obtained at Serdang has been readily saleable locally during the year at prices ranging from $55/- to $50/- per picul. Although the Penang clove has always been considered superior to that from other countries there is little or no market with Europe for local produce at the present time.

Conclusions.

Experience at the Government Plantation, Serdang, demonstrates that cloves, contrary to popular belief, will succeed inland, provided that the trees have the advantage of good natural drainage. Cloves of excellent quality are produced and are readily saleable.

Trees commence bearing during the fifth year from planting in the field. Young trees in the second year of bearing yield about 3½ lbs. of dry cloves per season or approximately 2¼ piculs per acre per annum.

The loss of weight of prepared cloves at Serdang calculated on the fresh weight of unopened buds is about 70 per cent.

PADI EXPERIMENTS IN MALAYA, 1930-31.

PART I. SELECTION, BREEDING, CULTIVATION AND SEED DISTRIBUTION.*

The season 1930—31 was notable in that cultivation operations were delayed in all the larger areas by the exceptionally prolonged drought which was general throughout the country in the middle of 1930. Despite the late start, the rain fall was fairly well distributed and bumper crops were garnered in the large northern areas generally, quite good crops being obtained elsewhere throughout the country.

The season was also remarkable for the large numbers of rats which were encountered everywhere and the wide spread of damage due to stem-borers.

The present serious depression in prices of our chief export commodities has, in spite of heavy local crops and very cheap imported rice, caused cultivators to give serious thought to local production and drawn unusual attention to the needs of the local rice industry.

In the season 1929—30 experiments were in progress at two Stations and twelve smaller Test Stations had been established in the more important padi-growing areas. Since then, one new Experiment Station has been organised at Teluk Chengai by the Kedah Government and five new Test Stations have been established in suitable localities and were cropped in the last season, while it is probable that five or six more Test Stations may be established in the coming season.

The experimental work during the last season embraced selection and breeding experiments, centred at Titi Serong (Krian) and Pulau Gadong (Malacca), manurial experiments, and fields trials of the comparative productive abilities of various pedigree strains in numerous Test Stations. Also, in certain areas where they were deemed advisable, preliminary cultivation experiments of a simple nature were made. Experiments at Taiping in reclaiming mining land for padi cultivation, and researches on methods of pest control, particularly stem-borers, in Krian, were continued. Meteorological records of rainfall, temperature, etc., likely to provide information useful to agriculture, were maintained at Titi Serong, Pulau Gadong and Teluk Chengai Stations, and in all padi areas, vigorous rat destruction was instrumental in killing over 3,380,000 rats during the season.

Selection.

Selection experiments have been continued at Titi Serong and Pulau Gadong Experiment Stations and are chiefly concerned with the four popular varieties—Seraup (7—8 months), Radin, Nachin and padi Siam.

Trials of selected strains of these varieties, isolated on account of desirable qualities on adaption to special local conditions, were made at various test stations and multiplication or observation plots throughout the country. These trials, besides indicating the most suitable varieties for local conditions, serve

* Compiled from Departmental records by H. W. Jack, Economic Botanist.

as multiplication-centres for seed supplies of such varieties and at the same time, are of value as demonstrations to local cultivators who are enabled to see their own unselected types growing side by side with selected strains of superior value.

The best results are indicated in tables 1 and 2.

Table I. **Results at Experiment and Test Stations.**

Area.	Selected Strain.		No. of 1/40 acre plots.	Control variety.	Average yield per acre in gantangs.		Present. increase over control.	Significance.
					Selected.	Control.		
T. Serong	Seraup	36	12	Seraup	354±14	318±13	11	Not decisive.
„	„	48	12	„	336±11	„	6	„
„	„	Mix	3	„	346±16	„	9	„
„	Radin	2	12	Radin	288±11	262±16	10	„
„	„	4	12	„	272±22	„	4	„
P. Gadong	Nachin	10	5	Nachin	323±13	258±22	25	Positive.
„	Siam	29	5	Siam	321±16	225±14	43	„
„	„	76	5	„	292±17	„	32	„
„	„	18	5	„	277±11	„	23	„
A. Gajah	Siam	4	7	Siam	330±14	260±4	27	Positive.
„	„	29	8	„	400±26	„	54	„
„	„	78	6	„	350±24	„	35	„
Glugor	Seraup	36	10	Sekapoy	321±22	248±18	29	Positive.
„	Radin	4	10	„	288±16	„	16	Not dec.
„	Seraup	15	10	„	316±23	„	29	Posit.
Talang	Radin	4	10	Radin	517±18	378±29	36	Positive.
„	„	2	10	„	459±29	„	21	Not dec.
„	„	13	10	„	464±26	„	23	„
„	F. S.	27	10	„	433±31	„	12	„
Lenggong	Seraup	36	10	Seraup	711±54	582±43	24	Not dec.
„	„	15	10	„	699±35	„	20	„
„	„	1	10	„	664±45	„	14	„
„	Radin	2	10	Radin	640±37	309±30	107	Positive.
„	„	4	10	„	598±48	„	93	„
Kuang	Seraup	36	8	Padi Puteh	332±21	300±34	11	Not dec.
Dong	Seraup	36	3	Jambak Bawang	430±21	327±20	31	Positive.
„	Radin	7	3	„	410±10	„	25	„
„	„	13	3	„	420±17	„	28	„
„	„	2	3	„	373±14	„	14	Not dec.
„	Serendah	875	3	„	370±32	„	13	„
„	Seraup	48	3	„	390±21	„	19	„

As can been seen in Table I, many of the results are positively significant, the remainder being materially better than the controls but not decisively so, probably, at least in some areas, due to damage by rains before harvest. The range by which significance is judged has been taken as twice the amount of the standard error above and below the average yields per acre in comparison with similar range of error for the controls.

At Titi Serong, the harvest was very late and suffered severely from the March rains, so that differences have been reduced substantially; nevertheless Seraup 36 and Radin 2 maintained their good yielding reputations. As regards the results at Pulau Gadong, each trial plot was only 0.0045 acre in area but the plots were grouped together into small compact blocks to reduce variation due to soil and water conditions. In this area and in Alor Gajah, Siam 29 is outstanding for yielding capacity, has a stout straw and gives good eating rice although of poor milling quality. In all other areas, the trial plots were constantly 1/40 acre in area and in practically every case, the same number of randomised plots were used in calculating the yields of control varieties as of the selected strains. At Glugor, floods damaged the crops considerably, but Seraup 36 again demonstrated its superiority. At Talang, Radin 4 proved a surprise in outyielding Radin 2 which has given such good crops in previous seasons. At Lenggong, the Radin control plots suffered severely from rains just before harvest which vitiated the results accordingly, making the selected Radins appear excessively good in comparison. Seraups 36 and 15 gave the best yields. At Dong Seraup 36, Radin 7 and Radin 13 gave excellent crops, but Radin 13 will probably be the favourite as an eating rice. The standard test station at Bukit Merah in Province Wellesley was the only station at which better yields were recorded from unselected seed than from selected seed in last season, when unusually good crops were harvested in the neighbourhood of this station, but even there, strains Radin 2, Seraup 36 and Seraup 15 impressed the cultivators for their good crops and stout straw, and in consequence, some applications for seed were received. The selected Seraup strain at this station showed higher tillering than the controls, but they suffered more from the rains at harvest than the control type because of their longer maturation periods.

At Titi Serong and Pulau Gadong Experimental Stations, the isolation of further strains of the varieties already mentioned was continued and in addition, strains of a number of other popular and promising varieties were included in last season's planting programme.

Among the new varieties subjected to selection methods, mention may be made of Mayang Ebos, Kunchor and Riong as promising types for cultivation in Province Wellesley, North Kedah and Perlis and of Padi Chubai which has distinct possibilities in areas affected by brackish water.

Attention has also been given to early maturing types, suitable for areas where water supply is scanty, and of these types Radin Siak, Padi Acheh and several strains of Serendah are promising and produced good crops in certain areas last season.

As different strains are required to suit different padi areas, it is necessary to maintain pure stocks of several strains of each leading variety, particularly of the 6-month varieties which have a wider distribution than the longer maturing types; hence, pure cultures of 10 Seraup strains, 6 Radin strains, 4 strains of padi Siam, 4 Nachin strains and numerous other less important strains in which cross-pollination was prevented by bagging, were maintained at Titi Serong Station.

Furthermore, a collection, representing all the chief varieties grown in Malaya, is maintained at that Station and promising types are isolated and tested against standard strains in replicated plots.

In last season, 16 types isolated from this collection were tested against Seraup 36 and five of them produced crops approximating to that of the standard strains and will be further tested next season.

In addition to trials of selections in Test Stations in the main padi areas, subsidiary trials were also conducted in several observation and multiplication plots scattered throughout rice-growing areas, and the better results obtained in these plots are summarised in Table 2.

The results in Table 2 need little amplification and indicate outstanding yields from Seraup 36 at Kuala Kurau, Budu and Sabui. Radin 13 was prominent at Tanjong Besar and Jelebu; at Penjom, Serendah 875 gave a considerable increase over the controls, and Radin 2, for the second year in succession, gave greatly superior crops at Semanggol. The last season was a late one, but nevertheless, suitable strains for several areas seem to be indicated by the results obtained, through all trials will be repeated for three seasons before definite conclusions are formulated. Many of these observation stations are situated in the Raub District of Pahang, in which it has been estimated that 70 per cent. of the padi planted is derived from selected strains distributed in the last few years with a consequent beneficial effect on the District padi production.

In addition to the results shown in Tables 1 and 2, appearances were such as to justify the supposition that selected strains yielded better crops than local types in many other instances, but misfortune in the way of pests and adverse weather have precluded statistical proof of the results, and in some areas (Pekan and Temerloh) the crops were entirely destroyed by floods.

Mixture of Selected Strains.

Two mixtures comprising (a) the four best Seraup strains and (b) the four best Radin strains were grown at Titi Serong in quadruplicate plots of 1/80 acre each and produced good crops, but records of yields were only taken from the Seraup plots because the padi in the block in which the Radin plots were grown was badly damaged by stem-borers and by rats. Observations last season, coupled with records in the previous season, indicate promise of useful results from mixtures of good strains and the experiment will be repeated in the coming season.

Table II. Results at Observation Stations.

Area.	Selected Strain.	No. of 1/40 acre plots.	Control variety.	Average yield per acre in gantangs. Selected	Control.	Percent. increase over control.
PERAK.						
K. Kurau	Seraup 36	6	Acheh	504±24	385±19	31
„	Radin 11	6	„	450±20	„	17
„	„ 7	6	„	426±33	„	11
B. Serai	Seraup 48	4	Radin	235±4	202±6	16
„	Radin 2	9	„	223±8	„	10
P. Buntar	„ 2	10	„	423±14	358±19	18
„	„ 4	6	„	388±11	„	8
Semanggol	„ 2	10	„	249±10	151±18	64
PERLIS						
Arau	Seraup 36	6	Local 8	446±13	413±27	8
			months.			12
„	Radin 2	6	Radin	461±27	460±21	
Salang	Seraup 36	6	Av. of 4	495±15	„	8
„	Radin 2	6	4 vars.	473±16	„	3
KEDAH						
T. Chengai	Radin 2	Single	Average	347	337	3
„	Siam 29	large	of four	360	„	7
„	Nachin 10	plots	varieties	402	„	19
F. M. S						
Kajang	Radin 2	5	P. Kuala	157	140	12
Penjom	Serendah 875	8	Local	560	405	38
Telang	Seraup 15	3	„	660	560	18
Budu	„ 36	3	„	680	540	26
T. Besar	Radin 13	3	„	680	520	30
B. Talam	Seraup 36	3	„	740	640	15
Bentong	„ 36	3	„	520	440	18
Sabui	„ 36	3	„	500	400	25
Sega	Radin 13	3	„	740	665	11
Semantan	„ 13	2	„	560	500	12
Jelebu	„ 13	4	P. Trong Kechil	359±66	286±13	26

Breeding.

Ten very robust hydrid plants representing crosses between Seraup 36, Radin 2 and F 27 (Nachin Rembau), with an usually high tillering (approximately 40 tillers per plant) were harvested.

Each of these heavy-yielding strains possesses desirable characters, and combinations between them should produce useful results in the next season. Further desirable crosses will also be made next season since a satisfactory technique has now been established.*

In an experiment to investigate the amount of natural cross-pollination which may occur under Krian condition, four very distinctive types of padi of the same maturation period were grown in closely planted adjacent and randomised lines in last season. Numerous typical ears of each of the four types have been selected from which to grow lines (ear-to-row) in the next season for examination as to any crossing or segregation of characters, when possibly useful information may be obtained.

Cultivation.

Simple cultivation experiments were carried out in Krian District on first class cropping land (Titi Serong) and on a third class area near Semanggol in single half-acre plots, to test the effects of tilling the soil as distinct from the usual method ("tajak"† only) of preparation of land for padi planting in this District, and the results are shown in the following table.

Table III.
Cultivation Experiment.

Area	Treatment	Strain used		Average Yield per acre in gantangs.	No. of 1/40 acre plots.	Increase.	Tillers per plant.
T. Serong (1st class land)	Nil.	Seraup	36	338 ± 16	3	—	12.7
	Changkolled*	"	36	323 ± 64	3	Nil	11.0
	Straw removed	"	36	327 ± 14	3	Nil	11.4
	ditto + changkolling	"	36	306 ± 11	3	Nil	11.3
Semanggol (3rd class)	Nil	Radin	2	249 ± 10	10	—	10.0
	Changkolled	"	2	314 ± 5	10	26%	11.3

* Jagoe, R. B. *Malayan Agricultural Journal*, Vol. XIX, No. 11, p. 530.

† Cutting down of the weeds at ground level with a special implement.

* To Chankol = to cultivate the land with a hand implement of the nature of a large draw-hoe.

In each area, all the plots were within the one field. The Titi Serong area suffered from excessively deep water during the growing period with a corresponding decrease in tillering. The plots show no material differences resulting from treatments. At Semanggol, cultivation gave a significant increase of 26 per cent. in excess of the control. This promising experiment will be continued.

Mechanical Cultivation.

A small experiment designed to give useful information regarding crops and costs of cultivation by mechanical means was carried out on an area of 3½ acres divided into plots varying in size from ¼ to 1¾ acres, at Pulau Gadong Experiment Station. The implements used were a Fordson tractor, an Oliver 2-share plough, and John Deere two gang 14 disc harrow. The land was dry-ploughed to a depth of four inches and disc-harrowed to produce a fine tilth. Seed was broadcasted and drill-sown in different plots. The broadcasted seed suffered so severely from the depredations of birds that the yields were very small and valueless as a test, while the drill-sown padi also suffered severely in this respect, water control not being sufficiently good to maintain an adequate depth for the protection of the seed. The drill-sown padi produced an average of 175 gantangs of cleaned padi per acre which, under the adverse conditions experienced, could be considered quite a fair crop.

The experiment was valuable in showing that 0.8 of an acre could be ploughed and 2.3 acres could be harrowed within the hour, although on larger plots it is likely that these rates could be accelerated somewhat. Further, the experiment demonstrated the necessity for reliable control of irrigation and drainage and indicated that, under favourable conditions, padi cultivation by mechanical means should be possible at a cost of from $21—$25 per acre.

Double Cropping of Padi Land.

An attempt to grow two crops of padi per annum is being made at the Glugor Padi Test Station, and during the last ordinary padi season duplicate 1/40 acre plots were planted with early ripening types of padi with the following results.

Table IV.

Yields of Padi of Short Maturation Period

Variety		Average yield per acre			Remarks
		in gantangs.	in lbs.	Local Padi	
Radin Siak		140	765	248 gantangs	Planted late
Nachin	10	284	1630	- do -	Fair
Serendah	824	162	880	- do -	Thin and uneven
„	756	260	1300	- do -	Fair
„	724	120	700	- do -	Planted too late
Radin	2	destroyed	by floods	- do -	

All the plots in which the above varieties were grown were severely damaged by deep water during three small floods, and stem-borer infection was also fairly destructive. Despite unfavourable conditions which naturally prolonged the growing period, the Nachin 10 and Serendah 756 produced quite good crops slightly above the average for the locality. After harvest each of the above type was immediately resown for planting in the "off" season, but the soil was not cultivated, the old plants merely being removed by the "tajak" to save time. Growth of all varieties for the first month after planting was quite good, but subsequently a series of five short floods was experienced and the padi was much damaged, and in June, only three—Serendah 756, Nachin 10 and Radin Siak—shewed promise of producing satisfactory crops, but further rushing floods have now (September) ruined those. While there is no doubt that a second crop of padi can be grown within the year, the padi at this Station has not had a fair chance this season on account of the lack of drainage control. Rainfall water runs off from the hills so very quickly that each heavy shower causes a small flood in the padi fields, but arrangements are being made for the provision of better outlets for excess water before next season.

The success of double cropping will depend entirely on co-operation amongst local cultivators, since there can be no returns from planting small isolated areas which are bound to suffer considerably from rats, birds and other pests.

Seed Distribution.

For last season, the distribution for cash of selected seed from Titi Serong Station on a large scale was organised by the District Officer, Krian, in the Semanggol Mukim where pedigree strain Radin 2 had been shown to be the most remunerative padi. 5,400 gantangs of this strains were sold to cultivators and much better crops than those from local unselected seed were obtained and gave general satisfaction.

For the coming season, it is anticipated that a further 2,000 gantangs of seed of the same strain (R. 2) will be distributed in the same and adjoining "Mukims". In addition, Titi Serong Station supplies selected seed of several strains to numerous Test Stations and to cultivators on application. A fair quantity of seed is distributed in this way annually, while the crops obtained at individual Test Stations are also largely used for purposes of distribution.

It has been reported that in the neighbourhood of many Test Stations, cultivators who planted selected seed are desirous of continuing to plant the same strains. This gives some conception of the local opinion of selected seed, although it is difficult to estimate the amount in use or the areas planted with selected strains.

Pests.

The chief pests of padi during the last season were rats and stem-borers. Field Officers in most padi areas instigated rat destruction measures with undoubted beneficial results as can be gauged by the large numbers of rats destroyed during last year—in Krian 1,791,790 rats, in Province Wellesley 1,514,928 rats, in Malacca 75,817 rats—while trapping and the distribution of specially prepared poison-balls were effective in many other areas.

The Entomological Division continued researches into biological methods (distribution of parasites) of combating stem-borers which have been very destructive during the past three seasons. An experiment was laid down in Krian to trace the effect of borers on late planted padi. In this experiment, 12 duplicated 1/16 acre plots were used and plots 1—7 (duplicated) were planted at intervals of one week with seedlings from the one sowing of padi Radin 2. Plots 9—12 (duplicated) were planted at intervals of two weeks, but the seedlings at each planting date were derived from successive nurseries, so that the young plants at the time of planting these plots were all of the same age (optimum) for planting.

Table V.

Planting Methods and Stem-Borer Infection.

Plots	Average percentage borer infection on				Average yield of padi per acre in gantangs
	4/2/31	24/2/31	5/3/31	14/3/31	
1 + 1	10	26	32	45	450
2 + 2	15	30	35	50	400
3 + 3	18	19	33	46	440
4 + 4	—	23	31		200
5 + 5	—	19	52		No crop
9 + 9	—	27	53		460
10 + 10	—	20	42	37	400
11 + 11	—	35	26	40	270
12 + 12	—	28	25	20	No crop

Yields were calculated on two plots of 1/40 acre each in each plot. The very old seedlings used in plots 5, 6, 7 and 8 produced very few flowers and set no grain. Similarly, the late planted but normal aged seedlings in plot 12 gave no crop. The table indicates that late planted padi suffers somewhat less from borer attack but at the same time produces less crop than earlier planted padi, and that late planted padi from good seedlings produced poor crops although apparently less virulently damaged by borers, but the whole season was so abnormally late that little reliance should be placed on the results.

Meteorology.

At Titi Serong Experiment Station, rainfall and evaporation records have been maintained since 1927. The records for the past 3 years are summarised below.

Table VI.

Rainfall and Evaporation Records at Titi Serong.

	Average Rainfall 41 years (inches)	1928 Rainfall (inches).	1928 Evaporation (inches).	1929 Rainfall (inches).	1929 Evaporation (inches).	1930 Rainfall (inches).	1930 Evaporation (inches).
January ...	5.35	5.92	4.612	1.22	4.820	3.03	5.106
February ...	4.22	2.52	4.740	9.86	3.560	2.91	5.127
March ...	7.56	5.03	4.946	8.52	4.752	6.65	5.810
April ...	8.41	10.97	4.218	3.81	4.458	3.93	4.538
May ...	7.01	7.08	4.716	5.71	4.918	3.18	5.328
June ...	5.11	6.69	4.494	6.41	4.718	3.11	4.934
July ...	5.29	4.18	3.878	0.40	4.684	2.58	4.824
August ...	7.05	2.91	4.422	1.65	3.962	4.91	5.402
September ...	9.50	12.25	3.430	12.27	6.426	7.18	5.796
October ...	11.73	8.51	5.282	8.98	4.300	15.14	5.138
November ...	10.62	13.12	4.324	12.92	4.270	10.36	4.474
December ...	6.94	8.47	4.076	4.73	5.768	6.64	4.290
Totals ...	88.79	87.65	53.138	76.48	56.636	69.62	60.767
Averages ...	7.40	7.34	4.428	6.37	4.720	5.80	5.064

The years 1929 and 1930 were exceptionally dry, particularly the latter, in which evaporation was apparently stimulated by the excessive dryness, and rainfall only exceeded evaporation by 9 inches.

During 1930 additional apparatus was obtained through the Meteorological Branch of the Survey Department, and records now include humidity, temperature, wind velocities and directions, and sunshine. Similar records which will be maintained at the Pulau Gadong Experiment Station should prove useful in course of time.

Summary.

1. It has been shown that several useful high yielding strains of padi, suited to varying conditions, have been isolated and tested against local popular but unselected types.

2. In many areas, selected strains have given more remunerative yields than the best local unselected types and in some areas, selected types are already planted over considerable areas.
3. There has been an advance in the number and in the organisation of Test Stations, though there is still need for expansion and improvement, particularly in relation to water control.
4. The best early maturing strains are Serendah 756, Nachin 27, Serendah 875 and Serendah 824.
5. The best strains of medium maturation period are Radin 2, Radin 13, Radin 4, Siam 29 and Nachin 10. This is the most important group in Malaya.
6. For areas which require a late maturing type of padi, the best strains are Seraup 36, Seraup 48, Seraup 15 and Seraup 1.
7. The search for better strains is being maintained and efforts are in progress to combine high yield and good eating qualities by the production of new races by hybridization.
8. Experiments in cultivation, pest control, and double cropping are in progress, and records of rainfall and evaporation in rice-fields have been tabulated.

PART II. MANURING.*

Experiments conducted previous to 1930 gave indications of increases of padi yield as a result of the application of phosphatic fertilisers. Ammonium phosphate gave the best results, while superphosphate, basic slag and Perlis (Malayan) phosphate were approximately equal. The increases were rarely large enough to be of practical importance and, although the experiments were continued for 6 years, statistically reliable evidence could not be obtained owing to insufficient replication resulting in large experimental error. In 1930 it was decided to abandon these experiments and to start a fresh series on more modern lines to be carried out at the Departmental Experimental Stations at Titi Serong in Krian, Talang at Kuala Kangsar and Pulau Gadong in Malacca. All three stations are irrigated, the first from the Krian canal system, the other two from rivers. Analytical characteristics of soils at the stations are given in Table I. Details of water conditions and pests during the season are to be found in the preceding section.

There were eleven treatments which, like the control, were replicated 6 times, arranged in 6 half-blocks grouped into 3 blocks. The area reaped for measurement was in each plot 1/40th acre †, guard rows of the appropriate

* Compiled from Departmental records by W. N. C. Belgrave, Plant Physiologist.

† Except at Talang, where by accident on a few plots only 1/80 acre was manured,

extent being provided to allow for bund effect. At Talang and Pulau Gadong the bunds were made of soil, were impervious and had little effect on growth; at Titi Serong they were composed largely of organic débris and were highly pervious. At the two former stations, bunds were constructed around each plot, while at Titi Serong, reliance was placed on the known high fixing power of local soils for ammonium salts and phosphates to prevent diffusion.

Following indications of previous experiments, attention was chiefly directed to phosphatic manuring. In order to test possible specific effects of ammonium phosphates, four of the treatment were sub-divided into application (a) of the synthetic manure and (b) of an ammonium sulphate-superphosphate mixture. All manures were lightly turned in and in addition at Titi Serong were mixed some weeks beforehand with damp soil in order to avoid loss and diffusion on application to the previously flooded fields. Details of treatments are given in Table II.

Two different kinds of padi were employed at each station, in order to test possible differential responses to manuring. At Pulau Gadong the varieties Siam and Nachin, at the other two stations the strains Radin 2 and Radin 4, were employed. All seed was from lines of known purity. It was originally intended that the distribution of the two kinds should be randomised, but difficulties connected with varying periods of maturation prevented this arrangement being carried out except at Talang; elsewhere distribution was by half-blocks. In consequence, some of the statistical advantage of the lay-out was lost as variation between half-blocks could not be separated from that due to differential response.

Dates on which operations were commenced were as follows:—

	Application of manures.	*Planting of nursery.*	*Transplanting.*	*Harvesting.*
Titi Serong	22.11.30	15.10.30	28.11.30	30.3.1931
Talang	2.10.30	28. 8.30	9.10.30	27.2.1931
Pulau Gadong	6. 7.30	7. 6.30	24. 7.30	19.1.1931

At Titi Serong weeds were cut close to the ground, allowed to rot for a fortnight, raked up and piled on the bunds as is the usual custom in Krian.

At Talang the land was turned over by hand cultivation to a depth of 6 inches, weeds being turned under in the process.

At Pulau Gadong the land was ploughed with a Malay plough.

Table II summarises results obtained, the two kinds of padi (and of manure in treatment I—IV) being taken together. For the sake of clarity, results are presented as pounds and gantangs per acre of cleaned dried padi; they were actually recorded in katies and gantangs at Titi Serong, gantangs at Talang and pounds and gantangs at Pulau Gandong. (1 kati = 1.33 lbs; 1 gantang = 1 imperial gallon.)

Statistical working has been carried out on weight figures except at Talang.

For conversion where necessary in Tables II and III the following factors have been used.

Titi Serong	1 gantang = 5.52 lbs.
Talang	1 „ = 5.74 „
Pulau Gadong	1 „ = 5.45 „

The Titi Serong and Pulau Gadong factors are derived from the manurial plots, that for Talang from adjacent plots.

There was little variation between races—Radin IV and Nachin being slightly the heavier, as shown in Table III.

The justification for the combining of different kinds of padi and of manures (in treatment I—IV) is to be found in Tables III and IV where differences are seen to be small.

The discrepancies in Table II between weights and measures illustrate the difficulty of accurate volume measurement of small quantities of padi.

Deductions.

The large increases recorded at Talang lose much practical importance when it is realised that the controls were far below normal for that station, possibly as a result of the land on which these trials were carried out having received poor tillage for a number of years.

On Pulau Gadong one treatment only (No. 5) shows significant increase and, at Titi Serong, increases, where they occurred, failed to reach the not unduly high standard of significance.

Since the control plots on the manurial areas did not give yields greater than the average of the Station it may be accepted that the lack of response is real and not due to raising of yields on the control by diffusion.

These disappointing results, added to those of former years, furnish strong evidence that manuring of wet padi on orthodox lines has a limited future on average land in Malaya. It is noteworthy that everywhere vegetative growth on the manured blocks was at the beginning markedly superior to the controls and that the differences were gradually lost at Pulau Gadong and Titi Serong, but persisted at Talang.

When considering the financial side it must be remembered that the more expensive treatments were definitely experimental. The fact that Perlis Phosphate alone gave good results at Talang suggests that nitrogen may ultimately be found to be unnecessary. If this proves correct, costs would be reduced by more than half, and comparatively small increases of crop, if certain of attainment, would justify the application of fertilisers.

The Talang results suggest that application of a cheap fertiliser might be useful on poor or neglected land to increase a first crop which would otherwise be small. This confirms the opinion expressed by the British Adviser, Perlis, as to the relative response to be obtained from good and poor land.*

*Report of Rice Cultivation Committee, F.M.S., 1931, Vol. II, page 122.

The large experimental error found in these experiments taken in conjunction with the equally large error shown by the varietal and other tests (Table I, page 578 supra) is surprising and unwelcome, and is being further investigated.

Experiments in the Coming Season.

Since the utility of orthodox forms of manuring appears to be limited it has been decided to broaden the basis of experiment. The new treatments will be :—

Nursery manuring with ammophos;

Nursery manuring with ammophos followed by field manuring with superphosphate;

"Chelluping" with bone meal;

Field manuring with a basic mixture;

Field manuring with a complete mixture containing nitrogen, phosphate, potash, calcium and magnesium.

"Chelluping" i.e. the old practice in Malacca of dipping padi plants at transplanting into a paste of bone meal or ground bones, has given indications of usefulness at Pulau Gadong. The basic mixture is designed to test the somewhat remote possibility that our acid soils may respond better to such a mixture than to neutral or acid fertilisers. The complete mixture is intended to test the equally remote possibility that there are several deficient elements, each of which must be added before response is obtained.

As the new experiments are to be carried out on the ground used last year, new treatments will be arranged to run "across" old ones in order to avoid possible residual effects, of which there were some indications at Pulau Gadong last season on land used for the older manurial experiments. Last season's treatments (Nos. IV, VI and X) will be repeated, and the land occupied by No. IX and XI will be used accurately to test residual effects.

At the new station at Bukit Merah in Province Wellesley a simpler experiment has been designed to test—

(a) Nursery manuring with ammophos.
(b) Field manuring with ammophos.
(c) "Chelluping" with bone meal.

Table I.

Analyses of bulked samples of soil.*

(a) Mechanical.

Station.	Clay per cent	Silt per cent	Fine sand per cent	Coarse sand per cent	Gravel per cent	Loss on ignition
Titi Serong	51	35	10	Nil	Nil	12
Talang	44	24	18	9	2	12
Pulau Gadong	33	37	29	Trace	Nil	7

* Topsoil; sub-soils (i.e. second nine inches) showed no appreciable variation.

(b) Chemical.

Station.	K_2O per cent	P_2O_5 per cent	CaO per cent	Fe_2O_3 Al_2O_3 per cent	Fe_2O_3 per cent	MgO. per cent	N. per cent	C. per cent	pH suspension	pH filtrate.
Talang	1.09	.08	.22	23.3	4.19	.41	.22	2.4	5.2	6.6
Titi Serong	.53	.06	.03	26.2	3.47	.01	.19	1.6	5.4	6.8
Pulau Gadong	.62	.03	.04	12.2	1.77	.45	.14	2.6	4.2	5.8

Table III.

Yield per acre from different varieties or strains.
Means of all treatments.

STATION	VARIETY, RADIN II.			VARIETY, RADIN IV.		
	lbs.		Gant.	lbs.		Gant.
Titi Serong	2,032	(5.49 lbs. = 1 Gant.)	370	1,998	(5.57 lbs. = 1 Gant.)	357
Talang	2,196	(5.72 lbs. = 1 Gant.)	384	2,258	(5.76 lbs. = 1 Gant.)	392
Pulau Gadong	1,857	*Siam.* (5.42 lbs. = 1 Gant.)	343	1,921	*Nachin.* (5.48 lbs. = 1 Gant.)	350

For reasons already given the significance of differences at Titi Serong and Pulau Gadong cannot be calculated; at Talang the minimum significant difference would be 131 lbs. or 25 gantangs per acre.

Table IV.

Average yield per acre from Ammophos and corresponding ammonium sulphate—superphosphate mixture.
Means of treatments I—IV.

	Ammophos.		Mixed manure.	
	lbs.	Gant.	lbs.	Gant.
Titi Serong ...	2,185	395	1,968	357
Talang ...	2,267	395	2,330	406
Pulau Gadong ...	1,866	342	1,777	326

TABLE II

Treatment.		FERTILISER	Quantity lbs. per acre	Nutrients supplied lbs. per acre [round numbers]. N.	P_2O_5	Cost per acre.[1]	YIELD IN POUND: TITI SERONG	Increase over Control.	TALANG	Increases over Control.	PALAU GADONG	Increase over Control.	YIELD GANTANGS: TITI. SERONG	TALANG	PALAU GADONG
I	(a)	Ammophos 20/20 ...	75	12	15	$3.94	2,234	319	2,080	656	1,960	160	390	361	357
	(b)	Ammonium Sulphate ... Superphosphate (single)	57 79	12	15	$4.26									
II	(a)	Ammophas as in I (a) ...	150	25	30	$7.88	2,234	319	2,253	829	1,680	120	400	391	308
	(b)	Ammonium Sulphate ... Superphosphate ...	114 158	25	30	$8.52									
III	(a)	Ammophos 24 of 20/20 76 of 13/48 ...	100	12	41	$6.01	1,968	53	2,225	801	1,960	160	360	386	352
	(b)	Ammonia Sulphate ... Superphosphate ...	57 217	12	41	$7.66									
IV	(a)	Ammophos as in III (a)	200	24	82	$12.01	1,915	nil	2,801	1,377	1,720	80	350	486	315
	(b)	Ammonium Sulphate ... Superphosphate ...	114 435	24	82	$15.32									
V		Ammonium Sulphate ... Superphosphate ...	29 193	6	37	$6.38	2,234	310	2,282	858	2,080	280	385	396	379
VI		Ammonium Sulphate ... Superphosphate ...	57 385	12	73	$12.76	1,862	53	2,415	991	1,960	160	334	419	352
VII		Ammophos as in III (a) Potassium Sulphate ... 90% basis	100[3] 40	12	41	$7.98	2,181	266	2,305	881	1,960	160	390	400	362
VIII		Ammophos as in III (a) Magnesium Sulphate ...	100[4] 117	12	41	$14.96[2]	1,968	53	2,300	876	2,000	200	350	399	371
IX		Perlis Phosphate ...	200	—	46	$2.24	1,068	53	1,879	455	1,800	0	366	326	324
X		Perlis Phosphate ...	400	—	92	$4.48	1,869	106	2,352	928	2.040	240	330	408	373
XI		Perlis Phosphate ... Ammonium Sulphate ...	200 57	12	46	$4.56	1,968	53	2,340	922	1,880	80	340	407	340
XII		Control ...					1,915	—	1,424		1,800	—	365	247	325
							Standard error of one plot.	404		388		260			
							Increase which would have significance P=0.05	425		403		270			

1. Calculated from cost per ton or per bag ex godown, Kuala Lumpur or Port Swettenham, July 1931. Cost to small buyers would be higher.
2. Epsom salts purchased at drug rates.
3. Supplying 19 lbs. K_2O per acre.
4. Supplying 19 lbs. MgO per acre.

THE PREPARATION OF ORGANIC MANURE.

A Preliminary Investigation

BY

R. G. H. WILSHAW,

Assistant Chemist,

Division of Soils and Plant Physiology.

The utilisation of waste vegetable products for the preparation of an organic manure is a problem which is engaging attention in the tropics at this time.

It has been found in other countries (1) that the incorporation of cattle manure with relatively large quantities of fresh organic waste such as grass cuttings, padi straw and other like material, results in an increased rate of decomposition.

This is of special interest to Malaya in that the recent introduction of stock by the Department of Agriculture to the Experimental Plantation at Serdang and to Fraser's Hill, foreshadows further development of cattle raising throughout the country and a consequent increasing quantity of available cattle manure.

The addition of cattle manure to a heap of freshly cut organic waste is equivalent to innoculating with a population of various micro-organisms capable of decomposing the organic material present. In the case of grass cuttings or any other freshly cut green material the water soluble constituents of both the cattle manure and the cuttings act as an immediate supply of food and energy for a rapidly increasingly micro-organic population; given the latter, the rate of decomposition and practical value of the resultant material is intricately bound up with the content, assimilation, conservation and loss of nitrogen and the chemical constitution of the original materials.

Pending large scale investigations which this Department contemplates carrying out at Serdang on the production of organic manure from vegetable waste and farmyard material, small scale experiments were started in January 1931.

The main object of these was the determination of the time-factor, the period over which the main experiments would have to be extended, and the frequency of sampling required.

In these experiments the reduction in 'pentosan' content of the organic material was taken as an index of decomposition, "pentosans" being determined by the method of Kröber (2)

This index has been used previously by Greenstreet (3) on work of this nature.

Recent work by Waksman (4) and Norman (5), on the nature and difference in rate of decomposition of the hexose, pentose, and uronic acid complexes (often term hemi-celluloses) in plants, casts doubt upon the value of this index for accurate work. However, as a rough index it was deemed to suffice for the following experiments.

Experimental.

Towards the end of January 1931, six concrete pits approximately 6 feet square and 18 inches deep, having a sump in one corner loosely covered with boards, were filled with a mixture of fresh grass cuttings and cattle manure.

The cattle manure was obtained from local Bengali cowherds, and being adulterated with soil was of very inferior quality. The loss on ignition of this material (on dry basis) was only 10 per cent.

Table I.

Weight of materials in each pit on fresh and dry basis.

Pits	Fresh Weight in Lbs.		Dry Weight in Lbs.		Proportion
	Grass Cuttings	Cattle Manure	Grass Cuttings	Cattle Manure	
1 & 2	225	375	68	122	1 : 2
3 & 4	150	450	49	146	1 : 3
5 & 6	300	300	98	97	1 : 1

In the odd numbered pits the mixture was arranged in three layers of each of cattle manure and grass cuttings; in the even numbered pits the whole contents were well mixed together.

The proportion of cattle manure to grass used in Pits 1 and 2 are approximately those used on Government Plantations in this country.

Pits 1—4 were under a glass roof, Pits 5 and 6 were exposed. All Pits were kept thoroughly wet (80—90 per cent. moisture) for the first two months. At the end of this period water was cut off and the material allowed to dry. Pits 1—4 thus became permanently dry, Pits 5 and 6 being dependent on weather conditions. As far as was practicable the sumps in every pit were periodically emptied.

The table below gives the "pentosan" content of the grass cuttings after various intervals under the above conditions. In sampling, care was taken to exclude any lumps of cattle manure or soil, and to confine the material as far as possible rigidly to the grass cuttings.

Table. II

Percentage "Pentosans" in grass cuttings (on dry basis).

Pit.	27.1.31	4.2.31	12.3.31	12.6.31
1	35.0	19.65	—	3.0
2	35.0	21.0	2.9	3.7
3	35.0	23.95	8.3	5.6
4	35.0	24.9	3.1	3.4
5	35.0	18.55	14.3	5.1
6	35.0	16.25	14.7	5.8

Conclusions.

Rapid decomposition of grass cuttings treated with cattle manure as judged by loss of "pentosans" occurs during the first week under 70—80 per cent. moisture conditions and at a mean temperature of 82°F., and, avoiding excess of water, this action is practically complete within seven weeks.

Literature Cited.

(1) Fowler, G. J. Agricl. Journal India Vol. XXV part V Sept. 1930.
(2) Kröber, E. Jour. Landw. 1900.48.357.
(3) Greenstreet, V. R. M.A.J. Vol. XVI No. 5 May 1928.
(4) Waksman, S. A. Soil Sci. Vol. XXXII, No. 2 August, 1931.
(5) Norman, A. G. Biochemical Jour. 1929, Vol. XXIII p 1353.

Reviews.

The Export Crops of the Netherland East Indies in 1930.*

Bulletin No. 97 of the Central Bureau of Statistics.
Department of Agriculture, Industry & Commerce, Buitenzorg,
September, 1931, pp. 253. Price 6 shillings.

The report defines the difference between local "estate agriculture" and local "native agriculture", gives general remarks on agricultural statistics followed by comparative statistics, since 1894 of the yearly total values of estate and native produce exported and particulars showing the economic importance of the Dutch East Indies as an exporter of tropical produce for the world's markets.

Value of Total Exports.

The statistical tables given shew the tremendous decline in the values of the exports of 1930, as compared with the preceding years, in consequence of the world-wide decline of market prices for agricultural produce. As before, the values of rubber and sugar exports combined constitute about half of the total value of agricultural exports. The figures (in Grs. 1,000) were :—

		Rubber	*Sugar*	*Combined*	*Total*
for 1929	...	233,429	311,592	545,021	1,082,757
for 1930	...	168,932	254,275	423,207	859,567

Proportionately this works out at:

21.56 per cent.	28.78 per cent.	50.34 per cent.
19.66 per cent.	29.59 per cent.	49.25 per cent.

Though the exports of sugar decreased from 2,946,440 metric tons in 1929 to 2,807,600 metric tons in 1930, it has fully maintained and even slightly improved its relative position. Rubber exports fell from 261,494 metric tons in 1929 to 243,258 metric tons in 1930. The difference is almost exclusively due to a decrease of 18,088 metric tons of native produce. The disastrous fall of rubber prices—especially for native produce, as will be shown later on—is responsible for the deterioration of its relative economic importance.

The value of the total exports of agricultural products from estates and native agriculture in millions of guilders was 1929, 1,083; 1930, 859.

As was to be expected, the total value of the 1930 exports has been far below the 1929 figure. Since 1925 this total value has been steadily falling

*A review of the 1929 Report (Bulletin No. 86) was published in the *Malayan Agricultural Journal,* Vol. XVIII, No. 12.

except in 1927 when there was a partial recovery. On the other hand, the volume exported has not decreased; the decrease of Grs. 224 millions is wholly due to the world-wide depression and the appreciation of gold. Relatively largest is the decrease of the value of native produce from the Outer Possessions from Grs. 291 to 189 millions. For 1925 the figure was Grs. 429 millions and it has been steadily falling ever since. This too was to be expected, because the bulk of the exports of native produce from the Outer Possessions has for the last 8 to 10 years been rubber, whereas there is no native rubber production in Java. Yet there, too, the decrease of the value of native produce exported has been relatively large. Compared with 1929 the decreases of the values of all classes of the 1930 exports (expressed in percentages of 1929 values) have been :—

Java		Outer Possessions		Netherland East Indies	
Estates	Native	Estates	Native.	Estates	Native
16.53	32 7	3.92	35 05	12.79	34.43

It should, however, be borne in mind that the figures, given above, represent values of exported produce only and that native agriculture in addition thereto supplies practically all food required by a population of about 61 millions.

N.E.I. Share of World Production.

As a producer of export crops for the world market requirements, the Dutch East Indies have, on the whole, fairly well retained their position, as will be seen from the following table which shows the principal Dutch East Indies exports in percentages of world exports.

		1927	1928	1929
Rubber	...	38	35	30
Sugar	...	10	11	10
Coffee	...	6	8	6
Tea	...	16	17	17
Cinchona	...	91	93	94
Copra, Oil etc.	...	23	30	30
Palm Oil & Kernels	...	3	5	5
Fibre (Sisal etc.)	...	19	19	22
Kapok	...	76	79	75
Pepper	...	53	70	69

For these and other export crops detailed figures are given in this publication firstly in a table specifying the volumes and values of their contributions, secondly, in special reviews dealing with each crop. The statements concerning

some of the most important crops are given below after conversion of planted areas into acres and of weights into tons of 2,240 pounds.

Rubber.

		Area in acres.		*Crop exported.*
Hevea.	Estates.	Planted	1,415,918	
	„	in bearing	912,417	151,113 tons
	Native	?		89,070 „
Ficus				27 „
		Total production exported		240,210 „

The report states that the production of British Malaya and of the Netherland East Indies during the last five years, expressed in percentages of world production, have been as follows:

	1926	1927	1928	1929	1930
British Malaya ...	46.79	39.73	45.30	51.93	53.92
Netherlands East Indies ...	31.65	37.60	34.83	29.88	29.04

Estate area, both that planted and the area in bearing, shows small increases only over the 1929 area; respectively 4.65 and 2.43 per cent. Estate production has been very slightly (0.4 per cent.) below 1929 estate production, due to partial cessation of tapping on some estates.

Native production decreased greatly in comparison with 1929 by 16.66 per cent. No estimate of potential production, present or future, is given.

Cane Sugar.

	Area in acres.	*Production in tons.*
Estates	489,275	
Native	33,541	
	522,816	2,869,947

Part of the native produced cane is sold to the factories; the remainder is converted into sugar for native consumption locally (Java) and in other parts of the Netherlands East Indies. The figure for total sugar production refers to factory produce only and includes part of native cane crop, bought by the factories.

The report further mentions an export of 17,480 tons of native made cane sugar, but this probably only means export from Java to the other islands for native consumption.

Coffee.

		Area in acres.		Export.
Estates	planted	322,063		
	in bearing	248,407		39,678 tons
Native	?			53,382 „
		Total export		93,060 tons

The estate planted acreage includes areas with mixed crops.

The total export figures shewn above for native production include exports of native coffee from some of the Outer Possessions to Java and other islands for local native consumption. This, combined with storage in times of low market prices, reduces the figure for the nett export to 60,545 tons. In the review of the Report on the 1929 exports a figure of 80,526 tons should, for the same reason, have been given for nett export.

The coffee-bearing area consists of :—

		Area in acres. Planted.	In bearing.	Production in tons.	
Robusta	Estates	299,416	231,602	37,775	
	Native	?	?	46,517	84,292
Liberia	Estates	5,879	4,566	293	
	Native	?	?	39	332
Arabica	Estates	13,052	9,859	1,269	
	Native	?	?	6,791	8,060
Other	Estates	7,710	5,192	341	8,060
	Native	?	?	3	344
				Total	93,028 tons

Tea.

		Area in acres.	Production.
Estates	planted	313,807	
	in bearing	257,122	56,720 tons
Native in bearing		79,245	14,137 „
		Total	70,857 tons

Production figures above include tea made from leaf bought from native growers.

The planted estate area has fairly steadily increased from 255,457 acres in 1926 to 313,807 acres in 1930 and the estate area in bearing from 221,673 acres in 1926 to 257,112 acres in 1930.

The planted native area simultaneously increased from 70,740 acres to 101,262 acres and the native area in bearing from 58,427 to 79,245 acres.

Tobacco.

		Area in acres.	*Leaf.*	*Krossok.*
Estates	Java	80,285	22,511	18,234 tons
	Sumatra	49,934	18,876	
Native	Java	369,701		24,068 „
	Other	?		483 „

Estate production in Java includes produce made from leaf bought from native growers. "Krossok" is the low grade tobacco that is cut up for pipe tobacco and used for cigar-fillings.

Quantities of native produced Krossok tobacco shewn above represent exports to foreign countries only. In addition thereto there is an inter-island trade of about 1,223 tons of native produce. No figures are given for local consumption or for total production.

Cinchona.

		Area in acres.	*Production. in tons of dry bark.*
Estates	Planted	47,171	
	in bearing	38,469	11,691 tons

Coconuts.

		Area in acres.	*Copra and copra equivalent of oil.*
Estates	Planted	127,583	
	in bearing	70,698	27,301 tons
Native		?	366,411 „
		Total export	393,712 tons

The total crop from estates shewn above includes 2,296 tons, made from nuts bought from native growers. The total export figure does not include the local native consumption which for 1930 was estimated to have been 390,750

tons for Java alone and in proportion to population may have been about 178,000 tons for the Outer Possessions.

The 1930 total export was 107,701 tons below the 1929 figure, partly owing to the drought and partly owing to the market prices which decreased copra production for export and increased local consumption. For Java alone the decrease has been 85,260 tons; Java during 1930 had practically ceased to be a copra exporter. Recovery, even in years of more favourable seasonal and market conditions, in the reviewer's opinion, is not likely to be more than partial, owing to the food requirements of the steadily increasing population and the scarcity of suitable land for new large scale planting. Estate production contributing only 7 per cent. to the total export; native production in the Outer Possessions (chiefly Celebes, Borneo, Sumatra & Riouw) already entirely dominates the situation.

Oil Palm.

Estates.	*Area in acres.* *planted.*	*in bearing*		*Production.*	*Export.*
Java	1,747	356			
Outer Possessions	149,550	73,997	Oil	48,978	47,258 tons
Total	151,297	74,353	Kernels	9,666	9,488 ,,

Production is likely to increase rapidly owing to the large area not yet in bearing.

Fibres.

The export of fibres amounted to 64,633 tons, of which 16,148 tons was estate produce and 48,485 produced by natives.

Area figures, being admittedly incomplete, have not been stated.

Tapioca.

EXPORT IN TONS

Crude dry tubers	Ground dry tubers	Flour	Flake	Pearl	Ampas
10,849	28,699	73,875	4,744	10,708	4,544

No reliable figures of the estate area can be given.

The area of native cultivation in Java is given at 1,606,150 acres, producing 5,133,858 tons of fresh tubers. Comparison of these figures for the last five years gives the following average yields per acre of fresh tubers :—

	Area in acres.	*Yield in tons.*	*Average.*
1926	1,680,280	5,411,417	3.22
1927	2,038,575	6,790,353	3.33
1928	1,826,069	6,063,977	3.22
1929	1,754,410	5,048,228	2.88
1930	1,606,150	5,133,858	3.20

The decrease of the native area in cultivation in 1930 was largely due to the drought during 1929, hampering planting. The relatively better yield produced a crop slightly exceeding the one of 1929. Native consumption increased to such an extent that the quantity available for export was greatly reduced. For the 4 years 1927-1930 the exports were :—

	1927	1928	1929	1930
Crude dry tubers ...	22,330	55,068	20,065	10,849
Ground dry tubers ...	94,498	270,224	98,075	28,699
Flour ...	102,941	124,922	114,918	73,875
Flake ...	4,926	10,176	6,824	4,744
Pearl ...	13,054	26,264	18,755	10,708

Even though it is probable that the native area, productive during 1931, will again be larger than in 1930, owing to more favourable conditions in the planting season, the figures seem to indicate that Java is declining fast in importance as a tapioca flour exporter and it may be well worth considering to what extent Malaya would be able to replace it as a supplier of the world market.

The figures given above relate to Java only. There is apparently no export of tapioca from the Outer Possessions.

Kapok.

	Area in acres		*Kapok*	*Seeds*	*Oil*	*Seedcake*
	planted	*in bearing*				
Estates	43,648	18,320	1656	3069	—	—
Native	?	?	19075	6164	2672	9173
		Total exports	20731	9233	2672	9173 tons

Practically the whole quantity exported comes from Java and this crop is predominantly native.

Other Products.

Cocoa.—The total area planted on estates is 22,944 acres of which 9,704 acres are in bearing and produced 1,185 tons of cocoa; native production accounting for a further 255 tons of cocoa.

Interest in this crop seems to be reviving and possibly it will remain predominantly an estate crop.

Pepper.—The estate area under this crop is stated to be 4,245 acres, of which 2,861 acres are in bearing. The total export was 31,889 tons, of which but 243 tons was from estates.

Gambier.—No gambier is grown in Java; cultivation (estate as well as native) is confined to Sumatra, Borneo, Rhio and Banka. The planted area on estates is 4,796 acres of which 4,136 acres are in bearing and exported 4,400 tons. The native area is unknown, but the exports from this source amounted to 8,939 tons, making a total export of 13,339 tons.

Arecanuts.--This is exclusively a native crop. The total exports were 41,926 tons, 7,461 tons of which were from Java and 34,465 tons from the Outer Possessions. North and North East Sumatra was responsible for 85 per cent. of the exports from the Outer Possessions.

Among other foodcrops grown chiefly for local consumption, rice, maize and groundnuts are most prominent. For Java the following production figures can be given : :

Rice.—(wet padi and hill padi together) 8,794,290 acres. Of this area 87 per cent. was irrigated and 13 per cent. dry land. The total production was 3,588,103 tons of rice in the husk, 93 per cent. of which came from the irrigated land whilst 7 per cent. came from the dry land.

The 1930 report for the first time gives production figures in weights of "rice in the husk" instead of "rice in the ear" as before. The former weight is about 54½ per cent. of the latter.

In 1930 Java exported 30,139 tons of husked rice to the Outer Possessions (chiefly Banka and Borneo) and imported from there (chiefly Bali and Lombok) 5,100 tons. In addition thereto Java imports husked rice from Burma and Siam. These latter imports fell from 329,603 tons in 1929 to 228,051 tons in 1930 in spite of its normal yearly increase of population by about 750,000.

For the Outer Possessions no reliable production figures can be given; only those for imports and exports. Only the islands Celebes, Bali and Lobok show an import surplus. The final nett import surplus for the whole of the Outer Possessions remained stationary; it was 396,060 tons of husked rice in 1929 and 396,059 tons in 1930. For the chief native rubber producing countries (Rhio, Jambi, Palembang and Borneo) the import surplus was :—

1928.	1929.	1930
146,588	115,991	106,106 tons
35.8%	29.4%	26.5% of the

total quantity imported in the Outer Possessions. Taking into account the normal increase of populations, these countries appear to have increased their local food production.

The East Coast of Sumatra—the centre of the large scale capitalist rubber, tobacco and oil palm cultivation, employing practically exclusively imported labour—imported 187,322 tons = 47.3 per cent. of the total. Banka and Billiton with their large population of mining coolies imported 50,750 tons = 12.8 per cent. of the total.

Maize.	*Area in acres.*	*Production.*	*Export.*
Java	4,944,470	1,974,705	77,561
Outer Possessions	?	?	39,165
	Total export to foreign countries		116,726 tons

This is an exclusively native-grown crop.

Groundnuts.	*Area in acres.*	*Production.*	*Export.*
Java	553,504	163,193	18,237 tons
Outer Possessions	?	?	1,247 „
	Total export to foreign countries		19,484 „

All weights are given for "shelled nuts". This too is an exclusively native-grown crop.

Sago.—The export from the Outer Possessions to foreign countries has during the last 5 years has been as follows :—

1926	1927	1928	1929	1930
15,080	25,468	32,511	41,396	50,735 tons

It is interesting to find that the East Coast of Sumatra has supplied 90 per cent. of the total increase since 1926.

Furthermore, mention of export to foreign countries is made of :—Potatoes 6,221 tons, Chillies 1,644 tons, Onions 1,526 tons, Cotton 1,386 tons.

L. A. J. R.

Journal of the Rubber Research Institute of Malaya.

Vol. 3, No. 2, October 1931. Price 50 cents.

The latest issue of this Journal contains two articles of very general interest to rubber planters on the subject of the manuring of rubber. The first of these gives a résumé of the present position on manuring of rubber with illustrative cases based on Malayan data, written by Dr. W. B. Haines and

Dr. C. F. Flint. It is an attempt to collate and interpret the information which the Soils Division of the Institute has collected during the past three years. A brief history of typical instances of manuring on estates is given with the results so far observed in each case.

In a great number of cases the results of manuring have proved uncertain, a fact which renders it impossible at present to recommend a manuring programme on a large scale with the certainty of economic success.

The best results appear to be obtained by the manuring of trees of good growth and appearance, but with poor yield. The manuring of trees of poor growth is not expected to give such rapid response to manuring as judged by yield of rubber; it is pointed out that "since both foliage and bark must necessarily be in a healthy condition to make steady high latex production possible, and since bark is slower to response than leaf, it is obvious that delay is to be expected. Within limits, it may be said that the time taken to obtain yield response is proportional to the time during which the tree has been allowed to deteriorate".

The authors warn the rubber planter to exercise patience in the conduct of his manurial experiments and not to abandon experiments because results are not quickly forthcoming.

The second article concerning the manuring of rubber is by the same authors and is a record of measurements of the development of trees under a controlled system of manuring at the Rubber Research Institute Experiment Station. The last series of measurements was made when the trees were just over two and a half years' of age from the time of planting.

The differences recorded are not large enough to be of practical importance, but significant effects have been produced by cattle manure. "In addition, girth was improved where nitrogen alone was given and total growth was improved by a complete chemical fertiliser, but none of the other figures are significant".

In a further article on the effect of covers and clearing methods on the growth of young rubber, Dr. Haines records the growth measurements on blocks of young rubber planted seed at stake, basket planted and planted with timber left and on cleared land. Under each condition of planting, areas have been cleaned weeded and other areas planted with plots of calapogonium, crotalaria and Leucana.

It is pointed out that "too much importance must not be placed upon early difference of growth, which are easily observed, without weighing factors which may come into play later". The present position shows that there is retardation of growth on the plots in covers, the effect being greater where rubber stumps were used than where rubber seedings were planted. The seed-at-stake planting is still behind, but it is rapidly catching up the rubber planted by the other methods. Basket plants have maintained a slight superiority over stumps on the plots with covers, but on clean weeded plots there is little to choose between them.

Records are also given of the growth of rubber closely planted and in which secondary jungle is allowed to develop. The conditions are designed to approximate those obtaining in native holdings. Amongst the interesting observations recorded in this connection is low incidence of *Fomes lignosus* at the present stage. This confirms the statement published in the last number of the *Malayan Agricultural Journal* respecting the incidence of root disease on native rubber holdings.

Other articles in this number of the *Journal of the Rubber Research Institute of Malaya* are "A further note on the effects of fungicides on the viability of Hevea buds" by R. P. N. Napper, and "The identity of the fungus causing wet-root rot of rubber trees in Malaya" by E. J. H. Corner.

D H. G.

Miscellaneous Tropical and Sub-tropical Florida Fruits.

by H. Mowry and L. R. Toy. University of Florida Agricultural Experiment Station Bulletin 223; January 1931, 88 pp. *74 figs.*

The Malayan reader of this bulletin will recognise in the excellent illustrations many fruits familiar to this country and several that are not represented locally.

Florida includes both tropical and sub-tropical regions, in consequence of which the authors have indicated by means of numbers the comparative hardiness of the fruits described. This is of considerable importance to readers in Malaya as it enables one to judge the chances of success of importations of these fruits.

The bulletin gives brief notes on propagation and cultivation of fruit trees. followed by a concise description and method of cultivation of some forty varieties of fruit trees.

If this is a fairly complete list of the tropical and sub-tropical fruits of Florida, one is struck by the fact that Malaya, although possessing a uniform climate throughout the country, contains a very much longer list of fruits. This does not, however, minimise the value of the Florida publication towards the possibility of improving local fruits or adding to their number by importations of stock from Florida.

The publication is recommended to those in Malaya who are interested in fruit cultivation. It is stated that a copy of the Bulletin will be sent free upon application to the Agricultural Experiment Station, Gainesville, Florida.

D. H. G.

Plant Breeding Abstracts.

Imperial Bureau of Plant Genetics School of Agriculture, Cambridge, England.
Published quarterly. 1s. 6d. per copy or 5s. per annum post free.

The Imperial Bureau of Plant Genetics has begun to issue a publication entitled "Plant Breeding Abstracts" in which all the more important current publications dealing with plant breeding and the genetics of crop plants are listed. The references are classified according to subject and each reference is followed by an abstract indicating the subject matter of the paper and the results obtained. The papers are divided into two halves, those published in the British Empire and those published in foreign countries. Papers written in foreign languages are usually abstracted somewhat more fully than papers in English.

"Plant Breeding Abstracts" Vol. I No. 3 published on April 1st, 1931, contains 197 references covering 52 pages.

Erratum.

With reference to the article entitled "Baled Copra" appearing in this Journal, Vol. XVIII, June 1930, page 281 et seq. it has been found that the figures on page 287 for the oil contents of 17 different bulk consignments of Straits F.M.S. copra as determined by consignees in Europe referred to the copra as received and not as stated to the product on a dry basis.

The amended figures for the table are therefore as follows:—

	Average per cent.	Maximum per cent.	Minimum per cent.
Moisture ...	4.7	5.5	3.9
Oil (wet basis) ...	65.0	67.0	63.6
Oil (dry basis) ...	68.2	70.0	66.2
Acidity (oleic acid) ...	2.19	5.36	0.35

Miscellaneous Article.

MEETING OF THE AGRICULTURAL ADVISORY COMMITTEE HELD ON NOVEMBER 5th 1931.

A Meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 5th November, 1931, at which the following members were present:—

The Acting Director of Agriculture, Mr. F. W. South (*Chairman*); the Director of Co-operation, Mr. A. Cavendish; the Director, Rubber Research Institute, Lt. Col. B. J. Eaton, O.B.E.; the Principal, Sultan Idris Training College, Mr. O. T. Dussek; the Raja Muda of Perak, Mr. M. J. Kennaway, Mr. J. Melville, Mr. R. E. M. Michaux, Mr. G. S. Reis, Mr. W. A. Stanton and the Assistant to Director of Agriculture, Mr. W. N. C. Belgrave (Secretary).

At the meeting various subjects were discussed, these included:—

1. *Re-organisation Proposals for the Department.* The Secretary of State had accepted the proposals of the Government of the Straits Settlements and Federated Malay States for the re-organisation of the European Staff of the Department and the necessary changes would be effected at an early date.

The construction of new laboratories and offices for the Department had been postponed.

2. *Padi.* The distribution of tested pedigree seed by sale in Krian, had not been a success, only 2,000 gantangs having been sold. This disappointing result was attributed to insufficient knowledge of the benefits to be derived from the planting of pedigree strains; in consequence the establishment of five Test Plots in Krian was envisaged and it was anticipated that three would be brought into being in 1932.

3. *Coconuts.* The report of the Assistant Chemist for Copra Research on his visit to Ceylon was ready and would in due course be published. The next step in the copra investigation was to be on the design and improvement of kilns.

Owing to the need for economy the proposed extension of the Coconut Experimental Station, Klang, had been postponed; an attempt was to be made to carry out eslewhere experiments on the manuring of young coconuts.

An attempt was to be made to obtain information on the effect of epiphytic growths on coconut and oil palms, as considerable sums were expended annually in removal of such growths.

4. *Oil Palms.* Fees for analysis of commercial products of the Oil Palm had been reduced.

5. *Serdang Experimental Plantation.* Estimates for 1932 were considered. The routine manufacture of tea was now in progress on the Plantation; approximately 50 lbs. per week were sold.

6. *Tobacco.* There was considerable interest in the commercial planting of low grade Indian and Ceylon tobacco and a good price was obtained in the Federated Malay States for leaf. Good growth with high grade virginian tobacco had been obtained on the Government Experimental Plantations, but a satisfactory cure was still the subject of experiment.

7. *Dairy Farm at Fraser's Hill.* Notices would shortly be posted in all Government Bungalows and the Rest House to the effect that fresh milk and vegetables could be obtained.

8. *Bark Consumption on Small Holdings.* Work on the measurement of bark consumption on small holdings had been started in the Federated Malay States, Straits Settlements and Johore and it was hoped shortly to include Kedah.

9. *Soil Erosion.* The Report on the Ceylon Committee on Soil Erosion which had been circulated to members was discussed, and the Committee decided to recommend that in Malaya a suitable combination of field works and cover crops should be employed and to record the opinion that agricultural practice in Malaya with regard to the prevention of wash was considerably in advance of that in Ceylon as disclosed by the report.

Work was reported to be in progress at Serdang on the establishment of covers on bare slopes where successful planting has in many cases proved difficult.

10. *Effect of grasses and covers on crops.* Experiments in the field and in pots in progress at Kuala Lumpur, Serdang and Klang on the effect of lallang grass and a leguminous cover on young rubber and coconut plants were described.

11. *Home Gardens.* It was decided, especially in view of the economic situation, that in 1932 an effort should be made to stimulate interest in home gardens by village competitions open to all races. A report on the successful home garden competitions recently held in the three Districts of Malacca had just been received.

Departmental.

FROM THE DISTRICTS.

The Weather.

Throughout Kedah and Province Wellesley the rainfall appears to have been less than the average fall for November and this applies generally to the inland districts of Perak. In Selangor, on the other hand, the fall was at many stations normal for the month and in some areas of Kuala Lumpur and Ulu Langat Districts exceeded the average total for November. The coastal stations of South Perak and Selangor received rather more than the usual November quota of rainfall whilst the Negri Sembilan and Malacca coasts received approximately a normal rainfall for the month. In common with the Kuala Lumpur and Ulu Langat Districts of Selangor, Seremban area received more rain than usual for November and this also applies to the Bentong, Raub and Temerloh Districts of Pahang. The rainfall for the month on the east coast was above the average, and included some very heavy downpours in 24-hours periods. At Kuala Pahang, for instance, 10.16 inches were recorded on November the 6th. and on the same date 7.34 inches were recorded at Pekan Agricultural Station.

Remarks on Crops.

Rubber.—Price quotations for the month for small-holders' rubber show the usual variations. The Penang quotation in dollars and cents per picul for small-holders' rubber ranged from $9 to $12.25 for smoked sheet and from $7 to $10 for unsmoked sheet, and quotations from most of the centres are this month very close approximations to these Penang prices, ranging from $9 to $12 for smoked sheet and $6 to $10 for unsmoked sheet.

As a result of the universal wet weather, Mouldy Rot fungus exhibited increased activity everywhere. Considering the circumstances obtaining, the measure of control attained must be considered fairly satisfactory. Although it is found impossible to clear up the disease in most places, yet most small-holders have been induced to perform more or less frequent paintings which has tended to prevent the great damage to renewing bark that takes place when Mouldy Rot receives no form of control whatever. Experiments undertaking by the Department in a locality in Selangor very badly infected with Mouldy Rot give support to the assumption that frequent paintings with a weak fungicide serve to prevent excessive drainage although eradiction of the fungus is not possible by this means, at least during wet weather and if the infection is of long standing.

Reports from the main padi-growing areas indicate that many holdings which have been out of tapping for some time are being brought into tapping again now that padi planting is finished.

Padi.—Reports from all quarters indicate that growth is generally satisfactory. In Kedah a rise of the Muda River caused total damage to about 150 acres through flood. Damage by salt water owing to high tides is reported from Kedah, Province Wellesley and the Krian District of Perak, but no extensive area was affected in any of the cases reported. The fulgorid bug, *Sogata furcifera*, is reported from Province Wellesley and most of the areas in Perak, although no extensive damage has yet been done by this pest. It is probable that lack of water movement in the Krian area, owing to the interruption to the usual irrigation arrangements, has made conditions more suitable for the increase of this bug.

Fair crops are being harvested in Selangor, although much damage is being done to ripening padi by the wet weather. An attempt is being made to get planting dates fixed at a more seasonable period than has obtained in this State for the past few years.

Requests have been received from cultivators in some areas in Selangor and Negri Sembilan for advice as to the possibility of growing a second crop during the usual inter-crop season. This matter is receiving attention.

Reports from Johore indicate that very considerably increased interest in padi planting is evinced in that State. In Muar District alone, requests for new padi land total approximately 13,000 acres.

Coconuts.—Investigations have clearly shown that the low price obtaining for copra from small holdings is intimately bound up with the poor preparation of the product and a necessary preliminary to better prices is to improve the preparation of copra. Working on this basis, an effort has been in progress for some time in Kuala Selangor District to effect improvement in this matter. Badly constructed kilns were the root of the difficulty. Two small kilns have been erected by small-holders on the advice of this Department and the copra now being produced from them is very superior to the product that has hitherto been turned out in this district. Arrangements made some time ago by the District Officer, Kuala Selangor, for improved selling arrangements of copra has enabled the owners of the newly erected kilns to obtain a price for their product which more nearly represents its true worth than they otherwise could have obtained.

Tobacco.—Little can be added to last month's summary under this heading. In North Kedah, as the result of propaganda work by the Principal Agricultural Officer, the curing of tobacco by Malays has been considerably improved. In Province Wellesley about 120 piculs of the cured leaf was prepared and sold during the month. Prices are approximately the same as those quoted last month.

Rat Control in Padi Fields.—Detailed reports received during the past few months from Krian show that the new system of control, which was introduced at the commencement of the present season, is proving a success. The present system relies for its success upon detailed frequent inspection of the whole area,

early reports of damage done and prompt attention thereto, and upon close co-operation with the headmen of the mukims and the subordinate headmen of small localities. Cultivators are now showing renewed interest in preventing damage to their crop and are tending to co-operate in preventing damage to a very much greater extent than they did under the old system, which for its success largely relied upon the payment of rewards for rats killed. The new formula for poison balls has been adopted after considerable trial and the balls now made are proving very satisfactory. In Province Wellesley the change over to the new system was not popular with the cultivators at first, but recent reports indicate progress. In Penang, where systematic control had not been introduced until this season, cultivators show great keenness to act upon the advice given them and there is a great demand for the poison balls.

Agricultural Stations and Padi Test Plots.

Kedah.—Telok Chengai Rice Station. Plants are making good growth. Examination was made of the plants raised from selected ears of local varietities for indications of hybridity. The reserve plot near the Station was planted with selected types of soya beans. His Excellency the High Commissioner and the Hon'ble the British Adviser visited the Station on the 4th. November.

Test Stations.—Plants are making good growth at all Test Stations except at Rantau Panjang where some temporary damage was done by flood water.

Gajah Mati Agricultural Station.—Fencing and levelling were completed and cover crops sown. A temporary store was erected and a short access road made to it.

Province Wellesley.—Glugor Padi Test Station. Planting was completed. Slight rat damage has occurred in one or two plots despite all precautions.

Bukit Merah Padi Test Station.—The water gate, which collapsed last month, has been repaired. Plants are making very good growth. *Sogata furcifera* has done very slight damage.

Perak.—(a) *Agricultural Station, Selama.* Erection of fence and store is well in hand and should be completed early in December. Budded kapok stems have been planted and the preparation of land for bananas is completed, four varieties having been purchased for planting. Cultivation of the pineapple plot is in hand and the nursery beds have been prepared for coffee, tobacco and other crops for which planting material is on order.

Kuala Kangsar.—Planting of the coffee area is in progress. There will be a good surplus of seedlings for sale to small-holders. Further planting of Chinese tobacco has been made. Budded kapok was planted and an improved variety of brinjal was harvested to provide a stock of seed for distribution to school gardens and to cultivators.

(b) *Padi Stations and Test Plots. Talang.*—Weeds have been very troublesome and a bad outbreak of *Sogata furcifera* occurred, first appearing in the

manurial plots. The banana area is ready for planting and only awaits the receipt of the variety Embun from Negri Sembilan.

Lenggong.—Good growth has been made and the appearance of the whole Station has considerably improved during the month.

Bruas.—The Station still has a patchy appearance due to the uneveness of the land. In certain parts, yellowing of the leaves persists. Tortoises have done some damage by nipping the plants above water level.

Bukit Gantang.—The dam again collapsed early in the month and the consequent shortage of water has favoured the growth of weeds. The shorter season varieties are making good growth. Some numbers of *Sogata furcifera* were in evidence at the end of the month.

Kamunting.—Except in Block 4 and the nursery area, the crop is making satisfactory progress, although further irrigation difficulties were again experienced owing to breaks in the main water course. The pests *Scotinophara coarctata, Nymphula depunctalis, Sogata furcifera* and stem-borers have been troublesome without having so far done very extensive damage. Tri-weekly liberations of parasites of stem-borers commenced on the 25th.

Selinsing.—Notwithstanding irregular water supply the crop is making excellent progress. The manured and deeply cultivated blocks are definitely superior in appearance to the control blocks.

Selangor.—Cheras Agricultural Station. The whole of the Station has now been finally cleared. Contour pitting of the higher part was completed and a cover crop established. Three clones of budded kapok were planted and buffalo grass has been planted along the side of a main drain to prevent erosion. Work on the buildings is still being delayed pending the decision regarding the financial provision.

Kajang Test Plot.—F. S. 27 was harvested by the pupils from the School of Agriculture. The yield was satisfactory, but actual figures are not yet available.

Kuang Test Station.—All the shorter term varieties of padi are ripening and Radin Saik was harvested at the end of the month.

Negri Sembilan.—(a) *Agricultural Station, Seremban.* The older pepper plants are producing a good quantity of fruit which is not yet ready for harvesting.

Rembau.—Fencing was completed and a propagating shed is in course of construction. Stops have been made in drains to prevent soil wash. Carpet grass and cover crops are making satisfactory growth.

(b) *Padi Test Plots. Rembau.*—Growth is very irregular. Sowings were made of a very short season variety to supply the local demand for the same.

Malacca.—(a) *Agricultural Station, Sungei Udang.* Tobacco nurseries were prepared and sown with five varieties. Yams were harvested. Good progress was made with the erection of buildings.

Pringgit.—Chiku marcots were supplied for the Singapore Station and

manuring of chiku and oranges was carried out to balance heavy marcottage.

(b) *Padi Stations and Plots.*—The Australian padi obtained last season failed to germinate. The five varieties of Italian padi recently obtained were sown. Germination was good in the case of three varieties, but indifferent in respect of the other two. Several short term varieties of padi commenced to flower.

Alor Gajah.—Weeding and rogueing was effected. Nachin and Siam varieties commenced to flower.

Pahang.—(a) *Agricultural Stations. Kuala Lipis.* Harvesting of tobacco and tapioca commenced. The soya beans, ubi kling and yam plots are making fair growth. The plots of maize which have made good growth are badly attacked by stem-borers (*Sesemia* sp.).

Temerloh.—Fencing was completed and the erection of buildings is nearly finished. A lay-out plan was drawn up and plots pegged off.

Kuantan.—Erection of buildings was completed and work is in progress on the preparation of paths and additional drains.

Pekan.—Maize, sweet potatoes and soya bean were planted. The dry padi is not making good growth, tillering is weak and weeds troublesome.

(b) *Padi Test Stations. Dong.*—Erection of a store was commenced and should be completed early next month. Short term varieties of padi have commenced to flower.

Temerloh.—Harvesting was continued under difficulties owing to the presence of water on the land. Ripening is very uneven.

Pekan.—Harvesting commenced with the reaping of the strain F. S. 27., All other varieties are in flower. The break of the monsoon will interfere with harvesting.

Singapore.—Pineapple Station. Growth of the pines still continues to be very slow and it it evident that some form of manuring will be necessary in order to obtain sufficiently healthy growth to furnish results from the experiments laid down. A small percentage of the plants have been found to be attacked by some form of "wilt" the cause of which is under investigation. Harvesting of the first crop of tobacco was completed. The results are encouraging but cannot be considered entirely satisfactory as yet. Improvements in methods of curing will be necessary in order to obtain the quality of leaf required for ready sale.

DEPARTMENTAL NOTES.

Demonstrations to Chinese Agriculturists.

On October 27th a party of 28 Chinese agriculturists from Kuala Lumpur and Sungei Balak attended a demonstration at the Govenment Experimental Plantation, Serdang.

As the members of the party were mainly interested in tea and tobacco, the time was almost exclusively devoted to these two crops. Particular attention was given to the method of pruning tea and in the use of cover crops and in the methods of raising tobacco plants from seed and transplanting into the field.

A further demonstration to 8 Chinese towkays from Kuala Lumpur was given on the Plantation on November 8th. Again, particular attention was given to tea and tobacco, the party being shewn the complete procedure from planting to manufacture. A visit was also made to the Stock Farm, where the Middle White pigs were greatly admired.

Attention was also given to other crops, including oil palm, coffee and pepper.

On November 20th a party of 9 Chinese agriculturists, accompanied by the Agricultural Field Officer, Selangor, attended a demonstration of rubber bud-grafting at the Rubber Research Institute Experimental Station, Sungei Buloh, Selangor. The party was greatly impressed by the method employed and its simplicity and efficiency. The manager of the station, who conducted the demonstration, was asked a number of questions, in particular relating to the objects of bud-grafting and the yields obtained.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 5th November. A résumé of the subjects discussed is included in this number.

Field work at the School of Agriculture Malaya.

That the practical side of agriculture is given sufficient prominence is evinced by the monthly reports of the Vice-Principal of the School.

Each pupil has a plot of land for the cultivation of which he is entirely responsible. In addition, various crops are cultivated on communal plots at the School. Recent work of this nature has included lining, holing and planting an area with rubber seed at stake, planting a rubber nursery and planting in baskets. Small areas have been cultivated and planted with tea, pineapples and dry padi. A coconut nursery has been established for the supplying of the School coconut area. An area has also been planted up with permanent fruit trees and with a cover crop.

Practical training this term has included a study of padi growth and pests and assistance in laying out the new Demonstration Station at Cheras.

The students also make periodical visits to the Government Experimental Plantation, Serdang, where they have recently studied tea cultivation and preparation, curing and pollination of tobacco, cleaning gingelly for the market, planting of tuba, ginger, turmeric and artichokes, contour silt-pitting and harvesting of tobacco.

Leave.

Mr. F. S. Ward, Assistant Mycologist, returned from leave of absence on 3rd October, 1931.

Mr. C. L. Newman, Agricultural Field Officer, returned from leave of absence on 7th November, 1931.

Mr. E. A. Curtler, Assistant Agriculturist, returned from leave of absence on 12th November, 1931.

Captain J. M. Howlett, M.C., Agricultural Field Officer, returned from leave of absence of 28th November, 1931.

Mr. R. G. Heath, Agricultural Field Officer, has been granted 8 months and 4 days leave on full pay with effect from the 13th November, 1931.

Statistical.

MARKET PRICES.

November, 1931.

Singapore prices of most agricultural products have generally hardened. At the end of the month it was reported that there had been a fair demand for most articles throughout the last week. Exchange went steadily against Sterling and this has hardened the value of several commodities.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 8.8 cents per lb. in November, the average London price being 2.9d. per lb. These figures are identical with the average prices for October. Fluctuations have been small, from 8⅝ cents to 9 cents and 2 7/16d. to 3d. per lb.

Palm Oil.—In the early part of November, the quotation was £20 per ton with a firm market. This improved to £21 per ton about the middle of the month. The price was maintained to the end of the month with a steady market. These prices are on the basis of 18 per cent. "F.F.A."

Copra.—Prices in November have shewn an encouraging advance on those of October. The average Singapore price in November of Sundried was $5.50 per picul as compared with $4.95 per picul in the previous month. The average price of Mixed was $4.83 per picul as compared with $4.46 in October.

Coconut Oil.—The average wholesale export price during November was $9.50 per picul. The demand for this commodity has slightly weakened, the tone of the market being dull. Copra cake averaged $2.10 per picul.

Gambier.—Block gambier has been quoted at $12 per picul nominal. Cube No. 1 has advanced to $22 per picul, the average price for the month being $21.62 as compared with $19.90 for October.

Rice.—The average wholesale price of Siam No. 2 ordinary rice, per picul in Singapore in October was $4.70 as compared with $4.14 in September. The retail market prices in October in cents per gantang of No. 2 Siam rice were Singapore 33, Penang 34, Malacca 28 as compared with 31, 32, 29 respectively in September.

Arecanuts.—Palembangs averaged $4.46 per picul, as compared with $4.55 in October. Being the beginning of the season, the goods arrived rather wet, and there is complaint that the sound quality is not as good as formerly. Bila Whole averaged $4.61 per picul against $4.25 in October. For other grades, the average prices in November were as follows:—Sliced, $9.25 to $11.75; Split, $4.75 to $6.44; Red Whole $6.87 to $7.58—all per picul, the price within each range depending upon quality. It is anticipated that the price of Red Whole will further decline. Owing to the rainy season, the new season's supply of Whole and Split are apt to be damp and the lustre less bright than in a dry season.

Coffee.—Prices of Java Robusta advanced towards the end of the month owing to small arrivals and a good demand for the Bombay market. The

average prices for the month were $16.25 to $17.88 per picul, the price between these limits depending upon quality. Corresponding prices for October were $15.10 to $17 per picul. Palembang coffee averaged $13.25 per picul in November, as compared with $12.65 per picul in October.

Pineapples.—The market became very active towards the end of the month, with sellers disposed to offer freely. Average prices per case for the month were 1½ lb. cubes, $3.74; 1½ lb. sliced flat, $3.42½; 1½ lb. sliced tall, $3.45 (nominal). Corresponding prices in October were $3.72, $3.43, $3.40 (nominal).

Tapioca.—Prices shew a decline on those of October. The following are the average prices for the month under review:—Flake, fair, $3.42; Pearl, seed, $4.59; Pearl, medium, $4.81 per picul, as compared with $3.60, $4.75 and $5.00 per picul respectively in October.

Sago.—This commodity has proved a fluctuating market, prices first advancing sharply, later becoming dull and closing with an advance, dealers having considerable outstandings and not keen to sell. The average prices for the month were:—Pearl, small, fair, $5.19 per picul, as compared with $4.78 in October; Flour, Sarawak, fair, $2.99 as compared with $2.36 in October.

Nutmegs.—Prices have stiffened considerably, supplies being short. For 110 per lb. the average price was $25.75 per picul as compared with $23.90 in the previous month; 80 per lb. $36.50 per picul as compared with $35 in October.

Mace.—Nominal prices are recorded for the month, the average being $63.75 per picul for Siouw and $48.50 per picul for Amboina, as compared with $70 and $46.40 respectively in October.

Pepper.—An improved tone is to be noted and prices have shown a small advance. The average prices in Singapore for November were:—Singapore Black, $21.81; Singapore White, $31.44; Muntok White $32.50. Corresponding prices for October were $19.90; $30.40; $31.40.

Cloves.—Nominal prices in Singapore have been quoted throughout the month. Average prices were:—Zanzibar, $46.25 per picul; Amboina, $51.25 per picul, as compared with $45 and $53.40 respectively in October.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs Cumberbatch & Co. Ltd., Kuala Lumpur; the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil mills, Singapore.

1 picul = 133⅓ lbs.

The dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.

October, 1931.

Malaya.—The total foreign imports of rice for October 1931 amounted to 55,768 tons, as compared with 62,710 tons for the same month of last year, of which 54 per cent. were into Singapore, 20 per cent. into Penang, 7 per cent. into Malacca, 15 per cent. into the Federated Malay States and 4 per cent. into the Unfederated Malay States.

Of these imports, 55 per cent. were from Siam, 41 per cent. from Burma, 3 per cent. from Indo-China and 1 per cent. from other countries.

The gross foreign imports of rice into Malaya from January to October 1931 were 587,624 tons. Net imports were 446,676 tons as compared with 492,571 tons for 1930, a decrease of 9.3 per cent.

Total foreign exports of rice in October 1931 were 15,787 tons as compared with 11,739 tons in September, 1931. Of these exports, 87 per cent. went to the Netherlands East Indies and 13 per cent. to other countries.

Stocks of padi and rice held by principal dealers and millers in the Straits Settlements and Federated Malay States at the end of September 1931 amounted as declared to padi 8,198 tons and rice 34,406 tons. The estimated amount of padi and rice held by dealers and millers in the F.M.S., S.S., Johore and on estates amounted to the equivalent of 52,589 tons of rice, as compared with 63,763 tons the previous month.

The imports of rice from all sources in September were :—into the F.M.S. 17,428 tons, Johore 6,586 tons, Trengganu 1,717 tons.

Perlis exported the equivalent of 204 tons and Kedah 1,840 tons of rice in September, 1931.

Reports from all States indicate that the planting work for the new season 1931—2 is in hand in all areas.

India.—Total foreign exports of milled rice during January to September, 1931 were 1,671,000 tons, a decrease of 568,000 tons or 25.4 per cent. as compared with the corresponding period of 1930, and a decrease of 239,000 tons or 12.5 per cent. of the past six years.

The First Forecast of the Rice Crop in Burma for the season 1931—2 issued on October 10, 1931 gives the area likely to mature as 12,203,100 acres, being 394,900 acres or 3 per cent. less than the final figures of last season.

Burma exports of rice and rice products (including exports to India) from January 1 to October 17, 1931, were 3,028,270 tons an increase of 3,822 tons over the corresponding period of 1930.

Japan.—According to the first rice-crop forecast for 1931, the area planted is estimated to be 7,949,404 acres, a slight increase over the previous year, and the yield at 8,129,775 tons, a decrease of 13.3 per cent. as compared with 1930.

China.—Manchuria. According to the International Crop Report, Rome, dated September 1931, the total area of padi and upland rice sown this year is 502,000 acres, an increase of 37,000 acres or 8 per cent. as compared with 1930. The total production in 1931 is estimated at 332,140 tons, an increase of 24,860 tons (8 per cent.) as compared with 1930.

Siam.—Exports of rice from Bangkok, (as reported by official sources) for the 10 months ending September 1931, were 991,773 tons, an increase of 80,050 tons or 8.8 per cent. as compared with the corresponding period of 1930, but a decrease of 159,078 tons or 13.8 per cent. as compared with the average of the corresponding period of the past five years.

Netherlands East Indies.—At the end of September 1931, the area harvested was reported to be 8,057,791 acres, a decrease of 158,062 acres (1.9 per cent.) as compared with 1930; the area damaged 402,549 acres, an increase of 185,580 acres or 85.5 per cent. as compared with 1930, and the area standing 926,275 acres, an increase of 48,585 acres or 5.5 per cent. as compared with 1930.

While the area harvested in Java and Madura was less than in 1930, the area planted and harvested is above the average of the years 1921—30.

Imports into Java and Madura January to September 1931 were 226,990 tons as compared with 215,947 tons for 1930, and in the Outer Provinces, January to August 1931 were 224,907 tons as compared with 254,291 tons for the same period of 1930.

French Indo-China.—Entries of padi at the port of Cholon for the first 10 months of 1931 were 964,291 metric tons, a decrease of 105,514 metric tons or 10 per cent. as compared with the same period of 1930.

Exports of rice from Saigon (January 1 to October 31, 1931) were 841,974 metric tons, a decrease of 129,588 metric tons (13.3 per cent.) as compared with the corresponding period of 1930.

The padi market in September was dull with a tendency to weaken owing to lack of demand. The stock at Cholon are high in comparison with the amount of business done.

The rice market for September was quiet. The market closed firm with considerable stocks at Cholon.

Ceylon.—Imports for 9 months ending September 30, 1931 were 330,224 tons a decrease of 20,601 tons or 5.9 per cent. as compared with the corresponding period of 1930, and a decrease of 13,435 tons or 3.9 per cent. as compared with the average of the same period during the last five years.

Europe.—To Europe, period January 1 to October 15, 1931 were shipped 946,186 tons as compared with 642,071 tons for the corresponding period of 1930.

To the Levant, period January 1 to September 11, 1931 were shipped 53,160 tons, an increase of 35,852 tons as compared with the same period of 1930.

To the West Indies, period January 1 to September 1, the shipment from the East were 119,805 tons, a decrease of 27.6 per cent. as compared with the same period of the previous year.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER, 1931.

PRODUCT	NET EXPORTS IN TONS.				
	1930	Jan 1— Aug. 31st, 1930	Jan 1— Aug. 31st, 1931	September, 1930	September, 1931
Coconut, fresh ...	10,475	6,858	5,326	996	840
Copra ...	102,014	56,559	60,774	9,948	10,054
Coconut Oil ...	9,475	6,319	6,640	948	772
Palm Oil ...	3,211	1,743	2,314	422	440
Palm Kernels ...	485	266	324	54	87
Pineapples, canned ...	57,689	44,728	45,334	2,237	1,782
Tapioca ...	31,195	21,120	19,788	2,392	2,153
Arecanuts ...	23,254	17,287	13,049	1,261	1,718
Tuba root ...	55½	—	46	—	3½

NETHERLANDS EAST INDIES AREAS OF PRODUCTIVE RUBBER UNTAPPED.

The following figures of productive rubber areas untapped are supplied by the Central Bureau of Statistics, N.E.I., Batavia and represent the acreages of tappable rubber on estates in the Netherlands East Indies which had entirely ceased tapping on November 25, 1931. Statistics regarding untapped areas on estates that have partly ceased tapping are not available.

	Number of Estates.	Total in acres.	Of which Mature rubber in acres.	In % of Totals productive planted areas 1930.	Production 1930 in Tons.
Java ...	(A) 79	68,908	29,482	8.4	3,653
	(B) 5	6,988	2,957		392
Outer Provinces ...	(A) 35	30,146	17,828	3.5	2,130
	(B) 8	1,522	773		112
Netherlands Indies ...	(A) 114	99,054	47,310	5.6	5,783
	(B) 13	8,509	3,730		504

(A) = rubber estates where tapping has been stopped, but which are still kept in running condition.
(B) = estates which are entirely or practically abandoned.

RUBBER AREAS UNTAPPED IN OCTOBER, 1931, IN THE FEDERATED MALAY STATES AND STRAITS SETTLEMENTS.

(Estates of 100 acres and over).

State or Territory	Area out of Tapping		Total area Untapped*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
	Acres.	Acres.	Acres.
Perak ...	8,302	28,468	36,770
Selangor ...	13,512	39,812	53,324
Negri Sembilan ...	15,093	25,731	40,824
Pahang ...	6,751	5,421	12,172
Total F.M.S. ...	43,658	99,432	143,090
Province Wellesley ...	3,169	7,900	11,069
Dindings ...	217	1,679	1,896
Malacca ...	4,646	18,118	22,764
Penang ...	747	137	884
Singapore ...	10,512	5,219	15,731
Total S.S. ...	19,291	33,053	52,344
Grand Total ...	62,949	132,485	195,434

* Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. & S.S. during October (not included in the above figures) were :—

F.M.S. 39,558 acres, S.S. 11,513 acres, Total 51,071 acres.

AREA OF "TAPPABLE" RUBBER UNTAPPED IN SEPTEMBER AND OCTOBER IN JOHORE AND KEDAH.

State	Area Untapped (Acre)				Total area untapped (b)	
	Estates which have entirely ceased tapping		Estates which have partly ceased tapping			
	Sept.	Oct.	Sept.	Oct.	Sept.	Oct.
Johore ...	24,411	22,985	48,364	46,092	72,775	69,077
Kedah ...	14,298 (a)		15,445 (a)		29,743 (a)	

(a) Kedah Returns refer to lands owned by Registered Companies only, and are rendered quarterly, commencing with June, 1931.

(b) Areas rested due to rotational tapping system are not included in the above table. The figures of areas untapped owing to rotational tapping system were for Kedah at the end of September 42,769 acres; Johore, end of September 31,751 acres, and end of October 32,112 acres.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF OCTOBER, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports including re-exports				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1931	during the month	during the year 1931	during the month: Foreign	during the month: From Malay States	during the year 1931: Foreign	during the year 1931: From Malay States	during the month: Foreign	during the month: Local	during the year 1931: Foreign	during the year 1931: Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	12,035	13,500	12,493	117,282	8,473	85,918	Nil	Nil	Nil	26	14,851	7,605	132,907	73,864	...	12,056	11,964
Johore	...	2,356	3,761	3,845	35,617	3,885	37,931	Nil	Nil	Nil	19	1,000	6,899	8,138	66,327	...	2,318	3,630
Kedah	...	450	3,220	2,279	21,194	1,224	10,561	Nil	Nil	Nil	Nil	558	3,017	6,184	26,022	...	425	2,173
Perlis	...	22	6	4	64	3	94	Nil	Nil	Nil	Nil	Nil	7	Nil	151	...	22	6
Kelantan ...	...	160	93	136	1,761	471	3,816	43	Nil	86	Nil	96	539	708	5,051	...	210	108
Trengganu ...	..	55	50	118	1,038	59	519	Nil	Nil	Nil	Nil	Nil	177	Nil	1,557	...	55	50
Total Malay States	...	15,078	19,630	18,925	176,956	14,115	138,839	43	Nil	86	45	16,505	18,244	147,937	172,972	...	15,086	17,931
STRAITS SETTLEMENTS																		
Malacca ...	...	2,955	1,480	1,503	12,700			Nil		Nil		4,562		44,250		...	2,688	1,364
Province Wellesley	...	122	512	481	4,625			Nil		Nil						...	109	578
Dindings ...	...	93	125	105	962	(2) 2,168	(2) 20,484	Nil	18,298	Nil	173399	5,976	Nil	60,415	Nil	...	105	134
Penang	1,824	2,927	7	8	75			492		5,871						2,109	4,279	9
Singapore ...	5,833	32,314	282	169	1,761			7,591		79,318		18,868		183,235		9,516	32,316	279
Total Straits Settlements	7,657	3,8411	2,406	2,266	20,123	2,168	20,484	8,083	18,298	85,189	173,399	29,406	Nil	287,900	Nil	11,625	39,497	2,364
TOTAL MALAYA	7,657	53,489	22,036	21,191	197,079	16,283	159,323	8,126	18,298	85,275	173,444	45,911	18,244	435,837	172,972	11,625	54,583	20,295

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	9,510	29,367	3,924	2,712	884	46,397
WET RUBBER	2,546	2,949	355	190	1,434	7,474
TOTAL ...	12,056	32,316	4,279	2,902	2,318	53,871

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	29,270	283033
Penang ...	10,317	99,311
Port Swettenham.	5,753	49,514
Malacca ...	571	3,979
MALAYA ...	45,911	435837

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ... / Straits Settlements	38,442	350667
MALAYA ...	38,442	350667

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. *i e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st November, 1931.

METEOROLOGICAL SUMMARY, MALAYA, OCTOBER, 1931.

Locality	Air Temperature in Degrees Fahrenheit: Means of A. Max.	Means of B. Min.	Mean of A and B	Absolute Extremes: Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	Earth Temperature: At 1 foot	At 4 feet	Rainfall: Total	Total	Most in a day: Amt.	Number of days: Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Bright Sunshine: Total	Daily Mean	Per cent
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	88.9	72.0	80.5	93	69	81	74	83.3	84.5	9.69	246.1	1.86	19	15	5	4	2	142.90	4.61	38
Bukit Jeram, Selangor ...	87.8	74.4	80.1	91	69	79	75	84.5	86.3	5.03	127.8	1.35	16	15				167.55	5.40	45
Sitiawan, Perak ...	89.9	73.1	81.5	94	70	85	75	84.8	85.1	7.60	193.1	2.77	19	16	1	1		186.15	6.00	
Kroh, Perak ...	84.3	69.7	77.0	88	67	74	72	80.5	82.1	13.97	354.9	2.10	25	23	1	2		155.80	5.03	
Temerloh, Pahang ...	89.6	72.6	82.9	95	70	76	75	85.0	86.1	5.11	129.8	3.16	13	9	2	8		148.60	4.79	39
Kuala Lipis, Pahang ...	88.6	71.5	80.1	94	69	78	73	83.4	84.4	7.69	195.3	1.54	15	12	12	16	1	135.10	4.36	36
Kuala Pahang, Pahang ...	87.0	74.7	80.9	91	72	80	77	83.7	86.0	16.07	408.2	5.55	20	17	2			143.55	4.63	38
Mount Faber, Singapore ...	86.6	75.1	80.9	91	72	80	79	81.8	83.3	9.21	233.9	1.79	17	15	1			154.00	4.97	41
Butterworth, Province Wellesley ...	86.2	74.3	80.3	89	72	80	77	83.9	85.2	13.13	333.5	2.41	23	21			1	166.85	5.38	
Bukit China, Malacca ...	84.9	73.8	79.3	87	71	81	77	82.9	84.2	7.23	183.7	1.98	20	15				176.25	5.69	47
Kluang, Johore ...	87.9	71.8	79.9	93	69	80	74	82.0	82.6	3.40	86.4	0.85	12	8	2	4		126.25	4.07	34
Bukit Lalang, Mersing, Johore	88.1	72.1	80.1	93	70	81	74	79.8	79.9	6.46	164.1	2.03	13	12	2			151.55	4.89	40
Alor Star, Kedah ...	85.9	74.0	79.9	90	72	77	76	85.0	85.8	17.62	447.7	3.32	20	20			1	165.95	5.35	45
Kota Bahru, Kelantan ...	87.1	73.4	80.3	92	71	77	75	83.5	85.4	24.20	614.7	6.73	18	16	2	1		164.35	5.30	44
Kuala Trengganu, Trengganu	86.4	73.0	79.7	92	69	76	75	83.1	84.5	32.23	818.7	15.79	27	20	11			141.95	4.58	38
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.4	58.9	64.7	75	56	62	61			15.19	385.8	2.16	21	19	1	4	3	122.35	3.95	33
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	70.9	57.9	64.4	74	52	64	62	69.4	69.8	14.36	364.7	1.91	22	22	1	3		124.60	4.02	33
Fraser's Hill, Pahang 4268 ft.	73.1	61.8	67.5	77	59	65	64	74.3	71.2	9.11	231.39	1.35	23	20	1	17	4	123.40	3.98	33

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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AUTHORS OF ORIGINAL ARTICLES.

Other Important Articles.

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